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ELECTRICAL REVIEW

FRIDAY
13 MARCH 1959

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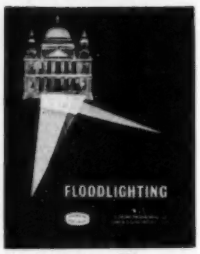

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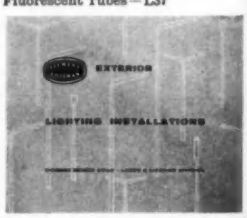

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ELECTRICAL REVIEW

13 March 1959 Vol. 164 No. 11 Established 1872

Scope of the Exhibition

NOWADAYS every industrial group considers it necessary to have its own exhibition and because electricity is important to every section of industry some electrical concerns are to be found in all such displays. As a result exhibitions have become a burden to many electrical manufacturers. There are some, of course, in which strong electrical representation is justified but there are many others in which participation is of doubtful value. In such cases instead of bringing electricity to the industries concerned it would be better for the movement to be in the other direction.

This is where the Electrical Engineers' Exhibition, which is being held next week, comes into it. From the preview of the exhibits which we give in this issue it will be seen that they cover a multitude of applications of electricity in all kinds of industries and thus form a real and comprehensive shop window of the electrical manufacturing industry.

The Exhibition has long outgrown its original aim which was to show electrical installation engineers what was available to them in the way of equipment, machinery and appliances, although it still serves this useful purpose. It has now become recognised as a potent means of acquainting a much wider circle with the products of British electrical manufacturers and that is why we suggest that industrialists of all kinds should see it instead of relying merely on what is shown at exhibitions arranged by their own sections.

When we refer to industrialists we do not confine the term to those in this country. The organisers of the Exhibition have in recent years made great endeavours to attract people from overseas to Earls Court. Many thousands of invitations to attend are circulated abroad well before the Exhibition and there are indications of growing interest in the show in export markets. It is claimed that visitors from over sixty countries saw last year's display.

The growth of the Exhibition to its present size, and it is continuing to grow, coupled with the change from its original character, suggests that

its present title is not strictly indicative of its real nature and purpose. It is no longer solely an electrical *engineers'* exhibition and to some extent the retention of the term may prevent it from attracting even wider attention. Of course the name has become established and for this reason the organisers may think a change to be undesirable. Anyhow we offer the thought but refrain at the moment from suggesting what new title might be adopted.

STORE ELECTRICAL INSTALLATIONS

This week saw the official opening of a department store recently completed in Southampton, and a description is published on the opposite page of the electrical installation for lighting and power purposes. One of the most interesting features is the use of concentric mineral insulated cabling in a sheath return system having a direct neutral connection to the supply authority's network.

The extent to which large stores of this type are customers of the electrical industry, in both its manufacturing and supply roles, is not generally appreciated. Such a store may require stand-by generating plant, motors, switchgear, cabling and lighting fittings, in addition to such installations as lifts and refrigeration and heating plant, to a value of the order of £100,000. Furthermore, the installation represents a fairly substantial load, and it is certain that the considerable use of electricity helps to sell goods because they can be displayed to advantage in clean and well-illuminated surroundings.

AMERICAN PLANT TENDERS

The continuing arguments over British (and other) tenders for generating plant for various authorities in the United States have revealed a determination of American electrical manufacturers to force their Government into action of some kind. At first it was suggested that higher duties should be imposed on imported plant but lately restriction or even exclusion has been advocated.

It is only fair to say that the arguments are not one-sided. Other United States interests are opposed to any such action and at the moment it seems to be unlikely that the Government will accede to the manufacturers' demands. However that may be, British suppliers should know where they stand in each case before they go to the trouble and expense of preparing tenders only to have them rejected for doubtful reasons.

POST-GRADUATE RESEARCH

That there are too few students carrying out research work in technical colleges was deplored by Sir Harry Melville, Secretary of the Department of Scientific and Industrial Research, in the course of his address at the annual general meeting of the Association of Technical Institutions last month. The lack of an accepted hall-mark for students who had successfully completed a post-graduate course at a technical institution was blamed as one of the contributory factors. The London graduate was, however, able to work for his Ph.D. externally. It was hoped that the newly-created Hives research qualification of " Membership of the College of Technologists " might prove to be an award as acceptable as the Ph.D.

The D.S.I.R. had always treated applications for post-graduate training grants from technical colleges as sympathetically as those from universities but only a small number of such students had applied. Sir Harry appealed to the technical institutions to endeavour to attract research students of a suitable calibre. He also pointed out that the D.S.I.R. did not insist upon candidates for research studentships holding an honours degree. We feel that the technical colleges should be playing a more important part in research work, perhaps of a more practical nature than that carried out at the universities.

POLITICAL OR COMMERCIAL?

When we commented in our issue of 13th February on the agreement between the United Kingdom and the six Euratom countries for the provision of nuclear power stations and fissile material we questioned whether the strictly commercial basis of the agreement was wise. It was pointed out that the United States Government was offering a ten-year supply of enriched fuel for future Euratom reactors on easy terms.

Apparently this consideration was instrumental in deciding the West Germans to reject British tenders for a 100 MW nuclear power station and proceed to consider three American offers. In reporting the matter the Bonn correspondent of *The Times* says that the basic price of the American reactors (employing enriched uranium) was somewhat lower than the British price but it was hinted that this was " possibly because of subsidies." The Germans are said to regret that the British cannot see their way to taking a more " political " and less commercial attitude, but that of course, must be a matter for the Government and not the atomic consortia who have to be " commercial " to live.

BALANCED GENERATION

The Loch Awe pumped storage scheme, in its amended form, was referred to the Secretary of State for Scotland during 1958. The purpose of this scheme is clearly stated in the annual report of the North of Scotland Hydro-Electric Board (*Electrical Review*, 6th March, page 432). While hydro-electric plant is suitable for peak-load operation, pumped storage forms the only practicable means of utilising excess power generated in off-peak periods by base-load plant. The large generating units (120 MW) now being installed and the future nuclear plant are of a base-load character.

Only about 4 per cent of the generating capacity of Great Britain is at present composed of hydro-electric plant. The North of Scotland Hydro-Electric Board has now harnessed about one quarter of the potential water power in Scotland and is pursuing new schemes to the limit of its resources. While the water power potential is limited, pumped storage projects are hampered only by financial considerations. Pumped storage schemes are of much greater importance than most people realise and it is to be hoped that careful consideration will be given to possible future projects.

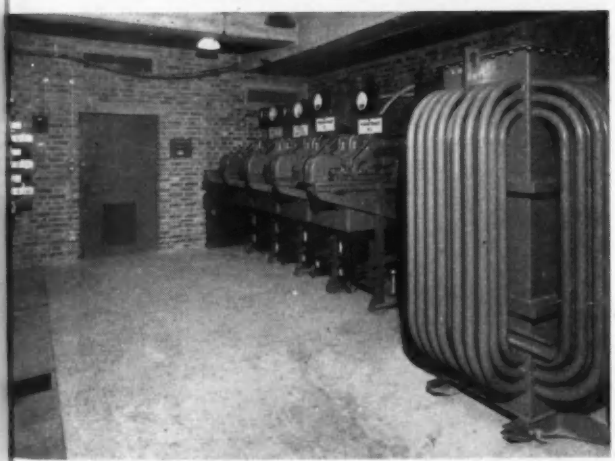
SHEATH RETURN CABLE USED IN LARGE SOUTHAMPTON BUILDING

Department Store Installation

A new store owned by Edwin Jones, Ltd., has recently been completed in Southampton, replacing a building destroyed during the war. A sheath return wiring system using concentric mineral insulated cabling has been used with a direct neutral connection to the supply authority's system. Fluorescent lighting has largely been used throughout the store, controlled in the public access areas by miniature circuit-breakers

ONE of the largest department stores in the country was opened yesterday (Thursday) at Southampton. Owned by Edwin Jones, Ltd., a subsidiary of Debenhams, Ltd., the new store in Queen's Way replaces the single-storey temporary structure used since the previous building was destroyed during the severe air raids on the town in the last war. The new premises, known as Queen's Building, cover a ground floor area of 106,000 sq ft. At present the ground, first and second floors provide a total area of 285,000 sq ft, of which 183,000 sq ft is trading area. A further 88,000 sq ft can be obtained by extending the upper storeys over an existing single-storey section, and provision has been made for services to an additional third floor for the whole building, if required. In addition to the normal sales departments and offices, a theatre, restaurant, cafeteria, canteen, kitchen and bakery are incorporated.

Oil circuit-breakers in the Southern Electricity Board's basement substation feed two 750 kVA transformers



The total installed load at present is some 1,100 kVA, but the load diversity experienced within the store gives a maximum demand figure of about 600 kVA. The basic carcase wiring has been carried out with mineral insulated concentric cable, manufactured by Pyrotenax, Ltd., using the sheath return system, and is claimed to be the first in this country in which a direct neutral connection has been made to a supply authority's system. Some 52,000 yd of this cabling has been used, with 37,000 yd of flexible cables for connections to the various fittings. There are nearly 4,500 lighting fittings, including over 3,000 fluorescent tubes, and more than 1,000 5 A socket outlets have been installed. A total of 125 motors with a combined output of 270 h.p. are used, ranging from $\frac{1}{8}$ h.p. units for ventilating and heating fans to 25 h.p. motors on lift duty, intermediate sizes driving escalators, pumps and compressors.

Electrical power is obtained from a Southern Electricity Board substation in the basement. Two Reyrolle type C3SC oil circuit-breakers connect the 6·6 kV mains from Above Bar North and Goughs substations to a busbar from which two similar breakers supply two 750 kVA Hackbridge & Hewittic 6,600/415 V transformers. The output from these transformers is taken through a distribution link panel, from which feeders are also run to the Board's general low-voltage system, to the store's main switchroom, also in the basement.

The supply is introduced to the main control panel, manufactured by the General Electric Co., Ltd., through a 2,000 A air-break circuit-breaker. The panel, which also houses the main metering equipment, feeds the various light and power distribution circuits through 36 switch-fuses rated from 60 to 200 A. A minimum switch rating of 100 A has been used, with grading effected by the fuses. Nine of these switches are of the change-over type, permitting selected circuits to be fed from a standby alternator, the controls for which are also included on

Thirty-six switch-fuses are incorporated in the main control panel in addition to an incoming circuit-breaker, metering panel and standby generator control panel

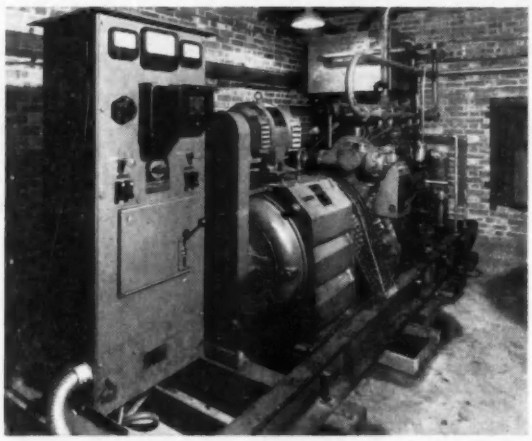
the panel. Each panel unit may be withdrawn for inspection or maintenance with the remaining units energised. Adequate reserve capacity and sufficient circuits have been fitted to supply a third floor, if required. A 100 kVA, 415 V, three-phase Brush alternator driven by a six-cylinder Paxman-Ricardo diesel engine provides a standby emergency supply. Also in the main switch-room is a panel containing three 200 A and two 100 A Donovan triple-pole contactors controlling external flood-lighting, window lighting and neon signs, each contactor being operated by an independent Venner time switch. An outdoor fireman's switch can override the time switches and de-energise the external lighting contactors, isolating the supply.

Other equipment in the basement includes four Davy-Paxman oil-fired boilers for steam and hot water heating, for which the control panel and equipment was supplied and installed by the Southern Electricity Board, and a calorifier unit with thermostatically controlled, motorised valves, the control panel for these being installed by the Thermo-Control Instrument Co. This panel includes a twelve-station multi-point remote indicator showing the ambient temperature and that in various parts of the building.

Single-core 0·1 sq in cable is used for the main risers from the control panel to the distribution points on the various floors. These comprise seven single-pole and neutral and 23 triple-pole and neutral fuse-boards, and 17 miniature circuit-breaker panels having from 12 to 90 ways. The fuse-boards, which have Santon or G.E.C. rotary isolators, control the light and power circuits in the office and storage spaces, the corresponding circuits in the public access areas being supplied through the circuit-breakers. The panels, made by G. P. Dennis, Ltd., and equipped with Walsall breakers, are divided into three sections controlling the general, display and pilot or police lighting, each section having a rotary isolator. Three panels are installed on each floor, one in each supply phase, separate circuit-breakers controlling the lighting in the various bays. Two junction boxes supplying two bays are fed from each breaker through a pair of four-core 0·002 sq in cables connected to give five general, two display and one pilot lighting circuits. Only single- or four-core cables have been used throughout the lighting circuit installation.

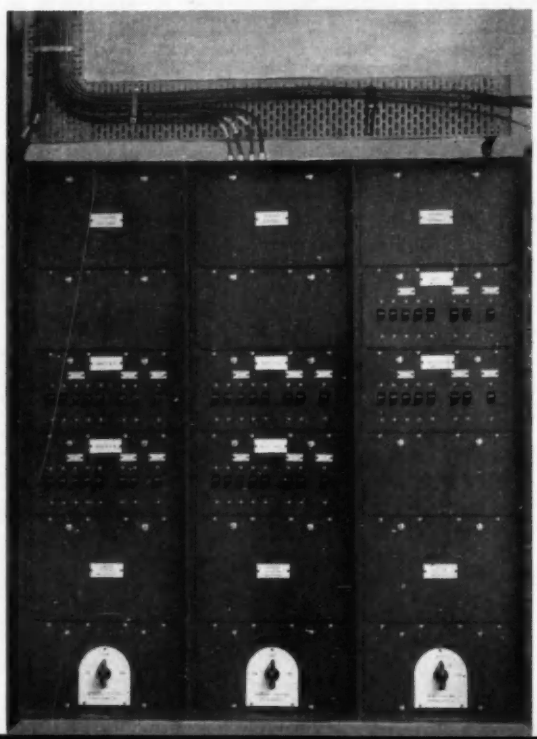
The "Oxford" lighting fittings used have been developed specially by the G.E.C. for this installation. The three types provided, for lighting main areas, stairways and perimeters, are each decorated with the crown motif used throughout Queen's Building. The fittings for lighting main areas are of a hollow square configuration and house eight 80 W, 5ft fluorescent tubes, providing an illumination level of 60 lumens/sq ft. The tubes can be switched from the circuit-breaker panel to use either the inner or outer ring of four, or both. To reduce the weight suspended from the ceiling, the tube control gear is remotely mounted above the false ceiling, approximately 120 yd of t.r.s. cable being needed to connect each fitting to the control unit.

In all showroom areas, 5 A three-pin socket outlets have been provided in the ceiling, four per structural bay, for temporary extension display lighting, the socket



A standby supply is provided by a diesel driven 100 kVA alternator

Lighting and power circuits in showroom areas are controlled from m.c.b. panels



providing electrical connection and mechanical support for the fitting. Fluorescent lighting is also used in showcases and fittings, controlled by individual switches and m.c.b.'s. Window lighting consists of alternate 150 W tungsten filament lamps and 125 W mercury discharge lamps in mirrored glass reflectors spaced at 2ft centres along the front of each window, with continuous rows of 8ft 125 W warm-white fluorescent tubes screened in ceiling recesses. Lighting fittings for sale are displayed in an area of 900 sq ft which has been fitted with a suspended ceiling with 96 sockets covered by removable panels, these sockets being controlled by four banks of 24 switches.

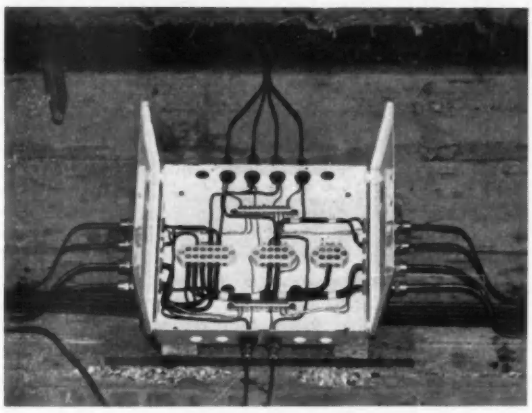
A 5 A switch socket outlet has been provided on each column throughout the showrooms for general-purpose use, including store cleaning apparatus and special displays, with a 15 A outlet to supply heavier loads if required. Similar 15 A outlets are fitted in the various offices.

For movement between floors there are four J. & E. Hall 8,000 passengers per hour escalators and two 16-passenger Otis lifts. Two Otis goods lifts, each of 4,000 lb capacity, serve all floors and a 36 cwt capacity Marshall Hunt lift is used to convey goods between the storage area in the basement and the vehicle loading bay on the ground floor.

A half-minute impulse clock system with 30 slave repeaters is controlled by a high movement type master clock made by Telephone Rentals, Ltd., who also supplied the three automatic one-minute impulse personnel time recording punch clocks. The clock system operates from a 40 V d.c. supply obtained from a battery which is trickle-charged by a Westinghouse selenium rectifier.

In addition to the manually operated private branch telephone exchange connecting with the G.P.O. system, a 150-line Reliance internal automatic exchange has been installed with extensions throughout the store. Also situated in the telephone room is the impulse transmitter of the high-frequency magnetic induction type staff location system installed by Multitone, Ltd. Loop transmitting wires are run in the ceiling void on each floor of the building and each person using the system has a small pocket receiver, tuned to a particular frequency, which gives an audible signal when energised.

The ceiling junction boxes are connected to the circuit-breaker panel by a pair of four-core cables. Four single-core cables are taken to lighting control units and four to ceiling socket outlets, while two single-core cables feed 5 A column mounted socket outlets



The lighting fittings are arranged throughout the store in a high brightness pattern system

Fire indicating and alarm equipment, supplied by Automatic Fire Alarms, Ltd., operates if an excessive temperature rise occurs in any one of the 24 sections into which the store has been divided for fire prevention purposes. Fire indication is given in the timekeeper's office and an alarm is simultaneously made at the local fire station.

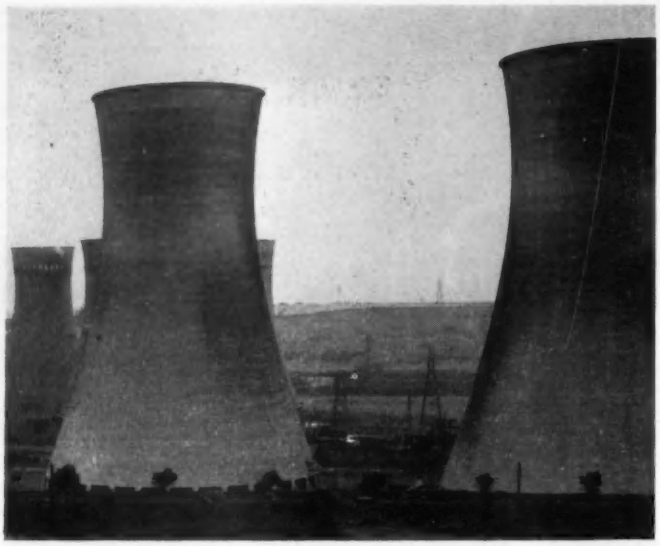
Throughout the building, particularly on vertical surfaces, wiring has been concealed—in false ceilings, ceiling voids and in cable risers, eliminating the need to bury cables in plasterwork and avoiding possible subsequent damage. Grouped cables in horizontal runs in the basement or in ceiling voids, and in vertical risers, are carried on Harvey cable trays. Cabling to socket outlets flush-fitted in floors at ground level and not above basements is carried in fibre conduit to prevent chemical action between the copper sheath and metalwork.

Special attention has been paid to bonding and earthing. All cables are terminated by Pyrotenax cable seals with earth tails, and these are connected to a bonding strip on control boards or, where this is not available, to the neutral bar. The cables are bonded together at several positions, including the main switchboard, adjacent to floor control panels and ceiling connecting panels, and on cable trays. This complies with the terms of the permission granted by the Ministry of Power for multiple earthing on a sheath return system, which required all joints in the outer conductor to be provided with duplicate continuity bonds, one having a current-carrying capacity not less than the outer conductor, and the other not less than the phase conductor.

Earthing of the cable sheaths is carried out in the main switch room, at fuse-boards or circuit-breaker panels, in ceiling connecting boxes and at all cable trays. The whole system is further earthed to the steel framework of the building, and to an earth plate in the substation from the neutral bar of the supply authority's low-voltage link panel.

The architects for the building were Messrs. Healing & Overbury, of Cheltenham, and the builders James Longley & Co., Ltd., of Crawley. The main electrical contractors were D. Alldridge, of Southampton, and the electrical consultant was Mr. A. W. Jervis, of Debenhams, Ltd.

Acknowledgment is due to Mr. C. D. Smith, O.B.E., managing director of Edwin Jones, Ltd., for permission to publish this article.



The rise in turbo-alternator set ratings has necessitated a corresponding increase in cooling tower size, in addition to associating only one set with each tower. The problems in maintaining tower efficiency arising from this increase in size have been overcome by improved packing design. New materials having a longer wearing life have been introduced and dry cooling towers and air condensers have been developed

Future of the Cooling Tower

By G. C. PARKINSON*

IN the early days of this century cooling towers associated with electrical generating plant were timber structures of very modest size, but with the ever-increasing ratings of turbo-alternators they have become very large structures built mainly in concrete with timber filling. In the early days both mechanical and natural draught towers were built of timber. Although mechanical draught towers are still constructed in both timber and concrete, natural draught towers are now almost entirely constructed of reinforced concrete. This change in the material for natural draught towers has been brought about by the change from small rectangular structures, which could be adequately braced internally, to large shell structures circular in plan and having no internal bracing. At the same time, the timber laths used for distributing the water were arranged more closely to give a better performance from the towers.

Size and Performance

The increase in size and the improved performance of cooling towers at first proceeded more rapidly than the growth in size of the turbo-alternator sets, so that until recent years it was normal for more than one turbo-alternator set to be associated with each cooling tower. The position has now been reached when the size of the generator has passed the point at which one natural draught cooling tower can dissipate the heat rejected. Associated with this change has been the reduction in the heat rejection per kW generated. From 1925 to 1955, this has fallen from approximately 6,700 B.Th.U/kW to 4,600 B.Th.U/kW, enabling a tower constructed in 1925 for a 50 MW set to be associated with a unit of 75 MW generating at today's conditions of pressure and temperature.

The larger cooling tower was developed when it was found to be proportionately cheaper than small towers, and further increases in size continued until this trend ceased. As the large installations were tested, several points came to light. It was found that the performance per cubic foot of packing of natural draught cooling towers using mixed flow cooling began to deteriorate. It was well known that cross-flow cooling where the air travelled horizontally and the water fell vertically through it was less effective than counter-flow cooling where the water fell through air rising vertically.

In large towers of mixed flow design, the distance the air travelled horizontally was increased causing it to be fully heated within the limits possible before reaching the end of its travel through the packing. The final portion of its travel was therefore creating resistance with no compensating heat transfer. The centre portion of large mixed flow towers was therefore relatively ineffective and the overall efficiency lowered.

Performance deterioration in natural draught cooling towers was cured by using counter-flow packings with a clear air space below, enabling cold air to be taken into the tower below the packing, and the cooling to be done in a counter-flow manner by the air ascending vertically through the packing.

On large mechanical draught installations, two troubles were apparent, both associated with the very low height of these towers. The discharge of large quantities of heated air at a height not exceeding 50ft above the ground resulted in some of the air being recirculated through the same or other cooling towers, raising the cold water temperature. In certain atmospheric conditions, the dense vapour emitted returned to ground level creating local fog. The recirculation of heated air in mechanical draught towers has been reduced by increasing the spacing between tower units and increasing the height

* Chief Engineer, Cooling Tower Department, L. G. Mouchel & Partners.

at which the air is discharged to about 80ft, but these measures have not so far overcome the problem of fog.

When the necessity for counter-flow packings in natural draught towers became apparent, considerable experimental work was started to obtain the most efficient packing. As there is a tendency for such packing to increase the pumping head required, one having a minimum depth, with a good heat exchange characteristic and low back pressure, is required.

Experience had shown that timber packings normally had to be replaced every 10 to 15 years, and this not only involved a considerable cost, but usually meant that the cooling tower was out of commission for two or three months. This led to the investigation of more permanent packings such as asbestos cement sheets, concrete splash bars, and glass or asbestos louvres. Recognising the short life of timber in cooling towers, work was put in hand to improve the preservatives with which the timbers were impregnated in an effort to increase the life of the timber. This has produced promising results, and it does not appear likely that timber will be eliminated from future cooling towers.

It is known that splash packings are very good at adjusting mal-distribution of water, while film flow packings tend to accentuate bad water distribution. Film flow packings have normally been associated with trough distribution systems provided to give a uniform thickness of water film throughout the packing. These trough distributors are very susceptible to impurities carried in the water and once the thickness of the film has been disturbed the performance of the cooling tower is seriously impaired. Work is now going on to develop a splash distribution system which will give an almost uniform distribution of water on film packings, making it possible to obtain satisfactory performance from film flow packings over a longer period. This is essential with permanent materials such as asbestos, for no advantage will be gained from permanent packings if the performance obtained from them will seriously deteriorate over the longer life of the packing.

A natural draught cooling tower having a corrugated asbestos sheet packing fitted for counter-flow cooling is now under construction. The tower is smaller than would be required with a timber filling, but the overall cost is similar owing to the higher cost of the asbestos packing. Plastic materials and glass have been tried for film flow packings, but generally an absorbent material produces a tendency to equalise the distribution of the water in film flow packing while non-absorbent materials have a tendency to cascade the water into rivulets with resultant loss of performance. Each country has developed cooling towers of its own design, the technique evolved resulting from the local relative costs of materials and labour, together with a requirement in some countries to build cooling towers that can be paid for in local currency.

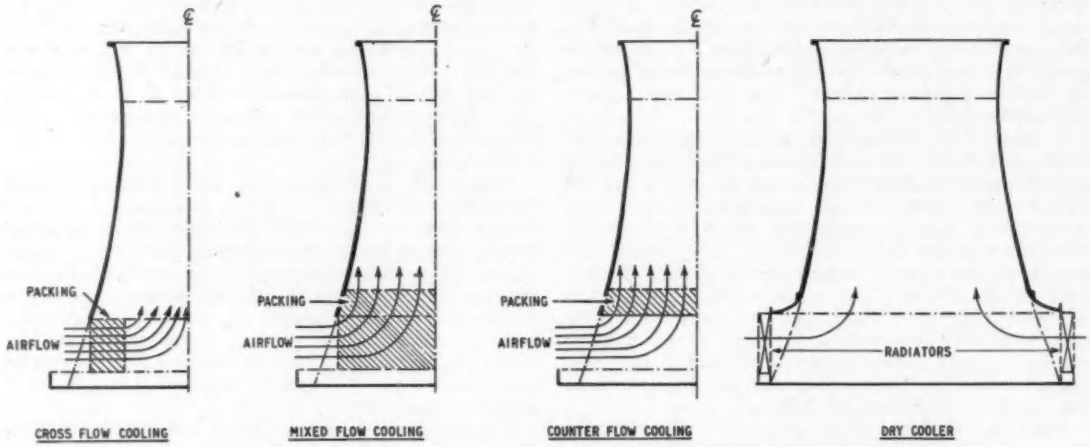
Natural Draught Towers

At the present time considerable interest is being shown in America in the natural draught cooling tower. Up to now mechanical draught towers with splash packings have been almost exclusively used there, but it is expected that in the future some natural draught cooling towers will be installed. These are most likely to be on large installations, as natural draught towers now require less ground space than mechanical draught towers, and this shows a saving in the cost of circulating water mains and cable runs. The saving on maintenance, though difficult to evaluate, should be considerable.

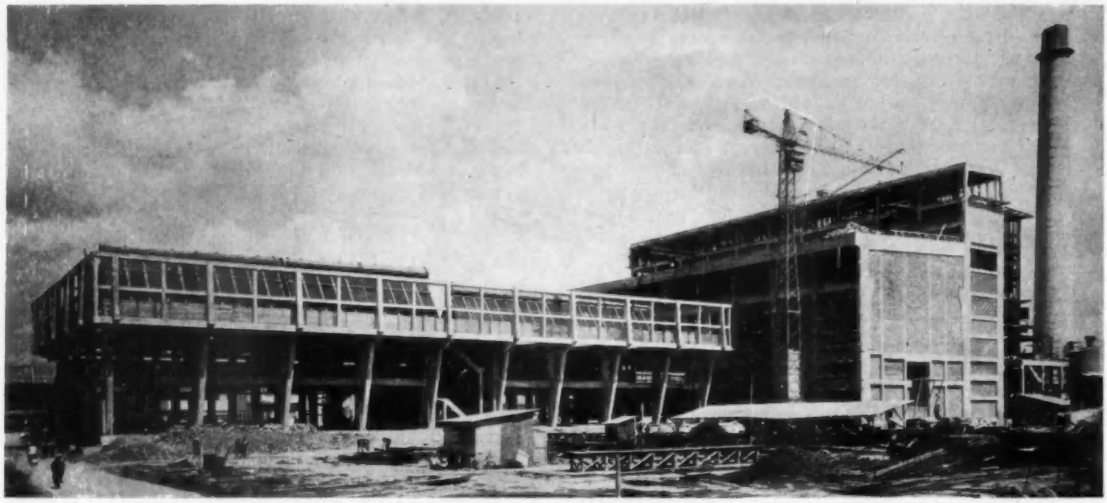
The advent of nuclear stations has not increased the demand for cooling towers in this country, as these stations are normally sited near coastal waters, providing adequate cooling facilities. At present, the nuclear proportion of the generating capacity being constructed is 10 per cent of the total, though it is possible that this proportion will be increased in the future, and it is unlikely that cooling towers will be required for nuclear stations for many years.

From the publication, "Il Calore," No. 3, 1958, Prof. Ing. Francesco Roma, "La Centrale Termoelettrica Città di Roma alimentata a lignite della Società Mineraria del Trasimeno," it appears that in Italy an air condenser has been installed for a power station in Pietrafitta. This consists of radiator units elevated on a concrete platform with air circulated through them by fans, and the illustration shows the large dimensions of the structure relative to the station buildings. A dry cooling tower is under construction for a power station in England. The scheme involves a natural draught cooling tower of very large dimensions provided with a high air opening at the base, and it is proposed to install the radiator units vertically in the air opening at the base.

In the air condenser shown in the photograph the radiator will be under negative pressure and any leakage



The schematic arrangements of various forms of cooling tower



Air condenser at Pietrafitta power station, Italy

will result in air being drawn into the condensate, while in the proposed dry cooler the radiator will be under positive pressure and any leakage will result in a loss of condensate. This second arrangement appears to be preferable.

It would seem that the wet cooling tower so well known in this country will continue to be improved so that the capacity of today's units will be increased. The radiator cooler will probably have a very restricted application, and this will only be in places where water is very scarce. Very little is known about the air condenser, and nothing about the comparative cost. It is certain that the number of cooling towers constructed in this country in the future will be considerably fewer than were constructed during the last 10 years, though they will all be larger in size than the earlier ones. The wet natural draught cooling tower will be required for many years to come and its development will continue.

CIVIL ENGINEERING AND RAILWAY ELECTRIFICATION

IN a paper presented before the Institution of Civil Engineers on 3rd March, Mr. R. E. Sadler (British Railways) discussed problems involved in changing over a railway track from steam to overhead single-phase 25 kV, 50 c/s electric operation.

A preliminary essential was, he said, to bring the track bed, the drainage and the track itself to a high standard for three main reasons. The first was the difficulty of making extensive improvements after a new and probably increased service had been introduced, since the track must at all times be registered, as regards line and level, with the overhead current-collecting system. The second reason was the greater punishing of the tracks by electric locomotives of present designs. The third was the need for higher speeds.

Unsprung loads had not generally been significant with steam locomotives, since the greatest weight came upon large-diameter coupled wheels giving large tyre-rail contact area. Small-wheeled uncoupled electric locomotives had greatly accelerated track deterioration, especially with the four-wheeled-bogie type (BoBo) with nose-suspended motor as compared with the six-wheeled-bogie design (CoCo). Nevertheless, the higher cost of the latter and recent experience in France with BoBo ignitron-rectifier locomotives, particularly in regard to starting torque, made further development of CoCo engines doubtful. The welding of rails into long sections was desirable to avoid rail-end batter.

Although with high-voltage single-phase electrification traction cables alongside the track were not required, a number of small cables remained for substation control circuits, telecommunications and colour-light signalling. These, when fixed on relatively low posts, were exposed to grass-fire hazard and they should be run in continuous concrete ducts buried flush with the ground surface or else run on tall posts.

Under the statutory order issued in connection with the Pringle report of 1932 (which related to d.c. at 1,500 and 3,000 V), the pantograph had to be 6ft wide over tips and from the generous proportions of this collector (although subsequently slightly reduced) had stemmed a considerable part of the installation difficulties involved. An overall width of pantograph of 5ft 3in was now favoured, which accorded with the latest French practice for high-voltage work, though the S.N.C.F. used insulated tips, which lessened the electrical clearances at the extremities but had advantages for some arch bridges and tunnels.

Among other civil engineering matters the author gave particulars of designs of partly pre-stressed concrete bridge decks on the Abeles principle, which permitted tensile stresses in the concrete under live load, though a compressive stress in the skin of the soffit of the deck obtained under dead load only. The first bridge ever constructed on this principle was erected near Barnsley in 1949. To meet the greater clearances required for 25 kV at overbridges, a very shallow partially pre-stressed concrete design (the first of its kind) was built at Colchester last year.

It was pointed out that any scheme of works must cause the least disturbance to traffic, which ruled out a number of academically sound schemes.

Economic Service Period for Meters

Author's summary of a paper entitled "Influence of Consumers' Load/Consumption Characteristics on Metering Practice" read before the Measurement and Control Section of the Institution of Electrical Engineers on 3rd March

By L. B. S. GOLDS, M.I.E.E., F.R.S.A.*

THE cost of supplying electricity can be divided into two parts, the capital cost of the plant and buildings, and the cost of the fuel, wages, etc., to operate and maintain the plant. In countries where water power is available the cost of the plant, civil works, etc., is high, but the running costs are low. Until more nuclear power stations come into operation, coal will still be the chief source of power in this country, and therefore the running costs are relatively high. This calls for a device to measure accurately the units used, hence the necessity for a kWh meter. At present the largest part of the revenue of the Area Boards is derived from the running charge. For domestic tariffs alone, this amounted to about £154 million for the year 1957-58, which is a third of the total income. It may well be that when the fixed charges become a much larger proportion of the costs of supply a demand indicator will be fitted to the kWh meter.

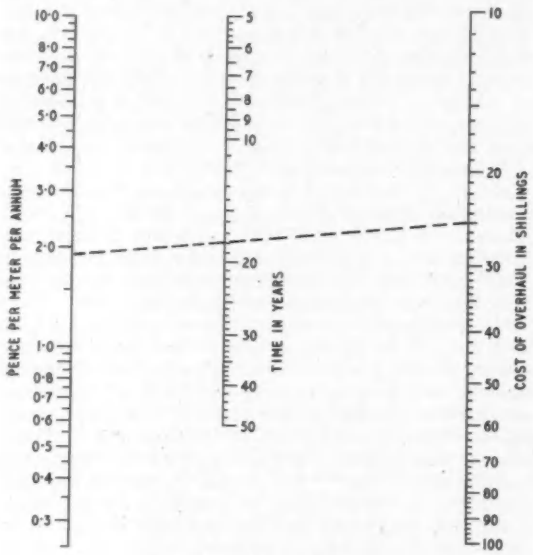


Fig. 1.—Meter service period nomogram

The meter serves two main functions apart from that just mentioned. First, in conjunction with the tariff, it encourages diversity of use of the supply but without restricting it, and second, as a consequence, it defines the size of the mains and generating capacity. We can therefore conclude that the meter is a fundamental factor in the operation of the electricity supply undertaking and in the development of the system in particular.

Tariffs are so designed that the readings of the meter when translated into sums of money provide for a large part of the income of the undertaking, therefore slow running meters on average would entail the raising of charges to offset the under-registration or the acceptance of a loss to the undertaking.

The consumer relies upon the accuracy of his meters to give him a correct account under the tariff, and for this reason the measurement tolerances of kWh meters have, since the early days of electricity supply, been governed by statute and errors are now limited by an Order made in 1937 to 2½ per cent high and 3½ per cent low.

Owing to a lack of information to the contrary, it has been generally thought that meter errors are so distributed that the consumption registered by the meters which over-register balances with those that under-register. In fact, this is not so, and furthermore, some of the errors stray outside the statutory limits after varying periods of service, but mostly in the slow direction.

The investigation described in the paper into the performance in service of domestic consumers' meters, of which there are now some 17 million, was intended primarily to give data to enable the effect of meter inaccuracy on an electricity supply undertaking's revenue to be estimated. This would then enable a decision to be made as to whether meters should be overhauled, and if so, permit an estimate to be made of the service period. Recently, the investigation has acquired greater significance as the Electricity Act, 1957, requires the Minister to prescribe suitable recertification periods.

To obtain the necessary information regarding individual consumers' load/consumption characteristics which often govern to a considerable extent the overall error of the meter, it was found necessary in 1947 to develop a patented load analysing meter. Data on feeders supplying a large number of consumers would not be related to individual meter ratings or to individual consumers' annual consumptions, which it is essential to know.

Between 1951 and 1955, over 400 of these load analysing meter readings were obtained in four representative areas referred to as A, B, C and D. Table 1 shows the percentage of annual consumption within the load

TABLE 1

Load Sub-Range	Average of all Samples	
	Proportion	Av. per Consumer
	%	kWh
Under 10 ...	16	274
10-25	21	353
25-100	51	898
Over 100 ...	12	219
	100	1,744

* Eastern Electricity Board.

current sub-ranges of the meters for all the samples combined. These data enable the total energy registration error or overall error of meters to be assessed with reasonable accuracy.

As a rough example of the use of these figures the average errors of all the meters in samples B, C and D can be considered. At 5 per cent, 25 per cent and 100 per cent load current the errors were −2·4 per cent, −0·9 per cent, −0·2 per cent respectively, and with the data from Table 1 we can proceed to weight these and arrive at a total energy registration error of approximately −0·8 per cent. The meters had been in service on average approximately eight years, and assuming the meters had increased their under-registration in a linear manner, it can be shown that the net loss of revenue is proportional to the square of the period during which the meter has been in service. Further, it can be shown that the economic period is when $T=\sqrt{\frac{2C}{l}}$ where T is the period in years, C is the cost of a maintenance operation in shillings, and l is the net loss of revenue at the end of the first increment of the period T. This calculation can be represented in the nomogram kindly prepared by Dr. G. F. Tagg, Fig. 1.

Now if the average annual consumption is 1,540 kWh and the price per kWh is 1·25d, then

$$l=\frac{0{\cdot}8}{8\times 100}\times 1{,}540\times 1{\cdot}25\text{d}=1{\cdot}9\text{d}$$

(where the average error is −0·8 per cent in eight years of service). Furthermore, if the total cost of removal, transport, overhaul, test and certification of the meters is 25s, then the economic period is as shown on the nomogram.

The data collected during these investigations showed that up to 80 per cent of consumers in a random sample had annual consumptions less than the average and that some 30 per cent of consumers had consumptions less than about 600 kWh/annum. Demand ammeters installed with the load analysing meters indicated that 30 per cent of the consumers could be metered safely and accurately with 5 A long-range meters. While alternative fuels for heating and cooking are available, it does not seem probable that the pattern of annual consumption will change appreciably.

The most important discovery of the investigation was that about 80 per cent of the consumption appears to occur in the load-current range up to 20 A, and some 30 per cent at currents up to 5 A. Owing to diversity in the use of apparatus, this distribution is not expected to change very much during the years ahead. This enables the most economic design of meter to be worked out.

Turning now to the statutory obligations of the Boards regarding the domestic meter and its certification validity period, it is suggested that this should be related to the inaccuracy in total energy registration of the meter. A meter whose registration over an accounting period is within the limits set down in the Order is correct, and therefore the period of recertification could be related to the number of meters which may be registering outside those limits. Since the consumers pay ultimately for the whole cost of meter maintenance, it is suggested that the validity period of certification might be assessed at the time when the estimated value of the revenue of the meters registering outside the limits balances approximately the cost of withdrawing and recertifying all the meters. Any lesser period causes unnecessary expense to consumers as a whole and any period in excess results in lack of equity. It must be remembered that there are large numbers of consumers with small annual consumptions, so that a period calculated on the average annual consumption appears reasonable since, as shown on the nomogram, this shortens the period in favour of equity and tends to limit the inaccuracy of those meters registering a large part of the consumption at low currents.

The total cost of domestic meter maintenance at present is around £1,400,000 per annum to which must be added the cost to the industry of lost revenue amounting to about £1,000,000 per annum. It is hoped to reduce this total by relating the maintenance period to economics, the essential data being the load/consumption characteristics in conjunction with the errors of meters of the various makes and types obtained by means of random sampling.

DISCUSSION

The discussion was opened by Mr. H. S. Petch, who said it was an interesting sidelight that while we in this country were tightening meter legislation primarily to improve equity, the trend in the United States was in the reverse direction, motivated by economy. There was certainly room for a qualified person to make a study of the economics of equity. On the statutory aspects, it should be recorded that both consumer and Electricity Board had a right to demand an official test on a meter. There was a regrettable tendency nowadays to concentrate on consumers' rights and the duties of Electricity Boards, and to forget the converse. Mr. Petch agreed that a revision of B.S. 37, Part 2, was now due. In his view there was a case for only one size of domestic meter because of the heavy costs of changing meters. Such a meter would emerge if it were accepted that 50 A was the ultimate ceiling for domestic demand, that loads exceeding about 30 A need not be registered with extreme accuracy, and that sustained accuracy was vital over the range 1·5 to 5 A. Such a meter might be called the 15/30 A meter, following I.E.C. practice.

Mr. M. Whitehead (Ferranti) suggested that by considering the problem of consumers in the mass there was a danger of giving them the wrong end of the deal. Attention should be directed to the tails of the distribution curve. This was the most dangerous part to work on and might mean much more careful sampling.

Mr. S. Howarth (Ministry of Power) pointed out that since the war the trend had been to fit large-size meters initially in anticipation of load growth, thereby saving the cost of changing meters. Evidence of utilisation research had revealed a large block of small consumers, and undoubtedly where an anticipated load increase had not materialised, over-metering existed. While the question of cost could not be ignored, the law required consumption, whether large or small, to be measured within legal limits, and that should not be overlooked in deciding meter size policies.

Mr. A. Felton said that the object of accurate metering was equity between one consumer and another. A meter should be changed when the cost of changing it, which fell on the consumers in general, was equal to the amount by which any one consumer was evading his proper share of the expense.

Mr. M. J. Mehler said that the author had picked out meters which all tended to run slow after a period of time. Sampling tests were carried out by the Midlands Board some time ago on 12 different makes of meters, and it was found that the errors varied anything up to about 8 per cent in either direction. The average error of the metering was almost zero. It was necessary to be fair both to those consumers who had fast meters and those who had slow meters.

Reliability of Paper Capacitors

Summary by the author of a paper entitled "The Reliability and Life of Impregnated Paper Capacitors" which was presented at an Ordinary Meeting of the Institution of Electrical Engineers on 5th March

By J. P. PITTS, B.Sc.(Eng.), A.C.G.I., A.M.I.E.E.

CAPACITOR reliability is a relative quality since, for example, capacitors with a mean life suitable for use in domestic radio receivers could be as reliable for their particular purpose as more costly capacitors with a much longer mean life designed for use in an important and inaccessible communication amplifier.

In any specific application the lives of a considerable proportion of the paper capacitors should be much longer than the useful life of the equipment employing them. This is necessary because the nature of failure mechanisms in an impregnated paper dielectric results in a wide spread of capacitor lives, particularly under d.c. stress. A ratio of 1:20 between shortest and longest lives in a d.c. life test is typical and, in this case, complete absence of failure in 10 years would require a mean life in the region of 100 years.

In many applications a need to replace a fraction of one per cent of the capacitors during the equipment's useful life may involve little cost or inconvenience but in certain special equipment, such as submerged trans-atlantic telephone repeaters, the designer endeavours to eliminate failures completely. At power frequencies, lives can be far closer together, particularly where ultimate failure is initiated by discharges in the capacitor dielectric.

For high reliability, paper capacitors must be hermetically sealed since moisture impairs the electrical properties of capacitor tissue and impregnants. Over a number of years the most reliable sealing methods have used either resilient insulation materials such as neoprene, silastomers and later, p.t.f.e., or soldered vitreous insulation. The highest humidity classification, H1, is usually obtained with the latter class of material, but this humidity class has also been achieved with thermo-setting epoxy resins.

Even in a perfectly sealed paper capacitor there are still three possible primary causes of breakdown which may, under particular conditions, contribute to various failure mechanisms. These primary causes are carbonaceous conducting particles (up to about 100 microns diameter) contained in the tissue, any substances which can dissociate in the dielectric and cause electro-chemical deterioration and small cavities or bubbles in the dielectric containing gases and/or vapours. The last are normally termed "voids."

Direct Voltage Stress

During recent years the electro-chemical nature of paper capacitor failure under direct voltage stress has been well established. Statistical analysis of the results of extensive d.c. life testing by the British Electrical and Allied Industries Research Association made it apparent that the wide spread of lives of similarly-processed capacitors must result from the distribution in the dielectric of conducting particles of varying size. Paper capacitors have two or more interleavings of tissue between the foil electrodes because the presence of at least one particle large enough to short-circuit one interleaving is inevitable. The incidence of a smaller adjacent particle (or particles) results in a variable minimum path between electrodes which determines the life of the capacitor, since electro-chemical deterioration is locally accelerated.

A point of great interest is the fact that the voltage stress to break down a typical present-day capacitor in one minute far exceeds the rated working stress of the capacitor (the ratio may be 10:1). Thus, although complete elimination of conducting particles in paper and capacitor manufacture does not seem a practical possibility, sufficient limitation of electro-chemical actions offers the possibility of extreme reliability under d.c. stress despite the presence of conducting particles.

In recent years the most popular approach to the problem has been the use of dielectric stabilisers which inhibit electro-chemical actions or accept harmful products of such actions.

Another approach to the problem of increasing d.c. reliability is a suggested short-duration high-voltage test applied to all capacitors in order to "kill" potentially early failures. This measure is only of value if the lives of the survivors are not appreciably shortened by the test. Workers at the E.R.A. and elsewhere are examining this scheme with the extensive testing that is needed.

Power Frequencies

Electro-chemical actions which occur in paper capacitors under d.c. stress do not necessarily proceed appreciably under 50 c/s a.c. stress and there is evidence that such actions can be made negligible at power frequencies by sufficiently drying the tissue and by impregnating it with a pure and stable dielectric material. Avoidance, by suitable design, of thermal instability and internal dielectric discharges up to a stress well above working stress, seems to offer a capacitor virtually free of all known deterioration processes at power frequencies. This theoretical ideal is usually modified in practice by the presence of extremely slow chemical deterioration and/or very slight electro-chemical action and, normally, a slow lowering of the required stress for inception of discharges. However, extremely long lives are obtained and with one popular impregnant—chlorinated diphenyl—whose use in England has expanded only during the last eight years (as against more than 20 years' common use in America), English workers have not had sufficient time to draw their own final conclusions on ultimate mechanisms of failure at or near working stress.

Gross contamination of paper capacitors with ionic impurities in materials of construction such as packing pieces can cause exceptionally early failure through electro-chemical deterioration and the E.R.A. have devised tests to detect such impurities.

Many results of current fundamental dielectric research bear directly upon paper capacitor performance and where

there is a real, economically-justified need for greater reliability, there seems to be considerable scope for improvement.

At power frequencies, no successor to the paper capacitor seems likely for many years to come. Despite the well-known limitations of paper capacitors in some communication applications, namely in respect of stability, losses at higher frequencies and relative bulk, their exceptional combination of low cost with considerable reliability will probably ensure continued d.c. use for many years.

DISCUSSION

Mr. C. G. Garton (E.R.A.) welcomed the use of the expression "wearing out of capacitors." He pointed out that it was not only capacitors that wore out; this applied to all insulation from the time a voltage was applied to it, and there were general mechanisms of breakdown, whether they occurred in a capacitor or a turbo-generator. All insulation had ionic conductivity, which implied transport of matter. However slowly material was transferred from the interior of the insulation to the electrodes, it turned up in ionic form and recombined to make something other than the original insulation. Even a perfect dielectric must be regarded as in a comparatively rapid state of disintegration for chemical reasons. Life tests on power capacitors had been in progress for three years at the E.R.A. The evidence, apart from a few cases, showed that the discharge-inception voltage, running the capacitors at 75 per cent of discharge-inception voltage, had not fallen over 12,000 hours. There was, therefore, apparently little evidence that electro-chemical changes would decrease the discharge-inception level; and that was what one would expect.

Mr. T. R. Scott (Standard Telecommunication Laboratories) said that after reading the paper carefully, he had come to the conclusion that there was still a good deal of contentious matter that was covered up by the integration of the whole story. It was all very well to say that with a good paper and the right conducting particles, and with a pure stable impregnating compound and proper pumping with the right vacuum, an excellent capacitor could be formed. But it was not easy to do these things in practice and one needed to know how efficient were the operators and the plant. It came to an art rather than a science in some ways. One difficulty was that the paper left the question of testing and the eliminating of early failures and the like a little too much in the air.

Mr. P. R. Coursey (consulting engineer) remarked that the present tendency to have everything as small and cheap as possible might produce misleading results. It might be cheaper in the long run to spend more initially to avoid wasting material in subsequent breakdowns. There were conflicting opinions as to the pre-service life test, but he himself had some predilection for it, not necessarily on theoretical grounds but because it was a practical way of eliminating potentially weak specimens. Probably the most important factor at the moment was quality control of materials and processes.

Mr. R. M. Barnard (Standard Telephones & Cables) thought there should be a reference in the title of the paper to oil. Capacitors using metallised electrodes were becoming popular and had useful application, but the mechanism of failure was drastically affected by the metallising procedure, and the mechanisms described in the paper would not apply. He did not know whether the author intended to suggest that the aluminium-cased capacitor with a rubber seal was an adequate design for a very high degree of reliability over twenty years, but he did not think this rubber seal could be expected to withstand the very small ingress of moisture that became important with such designs.

Mr. A. C. Lynch (P.O. Engineering Dept.) agreed with the author that the measure of reliability was not the hours of life of the capacitor. Account must be taken of the purpose for which it was used. It might or might not be desired to bring in the cost of replacing the capacitor: this could be very considerable if it happened to be at the bottom of the Atlantic.

Mr. W. A. Stickley (Thorn Electrical Industries) said the author had not mentioned the success or otherwise of capacitor seals. Leakage of impregnant was far too usual in these days and more work was required on this subject.

Mr. H. F. Church (E.R.A.) expressed surprise that the author had not referred to the quality of the paper. It was well known that with chlorinated impregnants, especially under d.c., kraft rather than rag paper should be used.

Mr. E. T. Norris remarked that emphasis had been placed, quite rightly, on first failure as distinct from mean failure. The only way to get at first failure was from statistical distribution.

Mr. F. Moores said that unless processing was constant and uniformly good it was difficult to make comparisons regarding materials. It started with the winding operation and completely wrong results could be obtained afterwards if anything deleterious were added in the way of dust, grit and so on. Drying and the speed of drying were also important and in this connection he emphasised the value of air conditioning.

Mr. C. E. Williams, who presented the paper in the absence of the author through illness, replied briefly to the discussion.

Atmospheric Pollution

A report on the Investigation of Atmospheric Pollution in the year ended 31st March, 1957, has been issued by the Department of Scientific and Industrial Research (H.M. Stationery Office, 7s 6d). Of its 136 pages, 124 are allocated to tables relating to the situations of measuring instruments and their types, deposited and suspended matter, SO_2 concentration in different areas and similar information.

Matters of chief electrical interest concern sulphur output and wind around Staythorpe power station. The observations confirmed that pollution was correlated with sulphur emission and could be fairly closely estimated at ground level by a plume of gas emitted from a chimney in a strong wind. The accumulation of pollutants was, however, greatest in light winds and no theory so far devised predicted the behaviour of hot gases in these conditions when the air was stably stratified, as during temperature inversions; experimental investigations were being made at Imperial College, London.

No known method for determining sulphuric acid in the presence of sulphur dioxide had proved satisfactory and further research was required. There was also a need for continuous records of concentrations of sulphur dioxide, for which the Central Electricity Generating Board had developed instruments to be available commercially.

Sulphur dioxide had been removed from flue gas by scrubbing with water containing manganese dioxide in suspension; an efficiency of 96 per cent was maintained even when the concentration of sulphuric acid produced reached 40 per cent. The initial product from the scrubber was 40 per cent sulphuric acid containing about 20 per cent of manganese sulphate in solution, which was removable by electrolysis and regenerated manganese dioxide. All the manganese sulphate had not yet been decomposed economically, however, to leave sulphuric acid of sufficient purity to be saleable.

VIEWS on the NEWS

By REFLECTOR

WRITING to *The Times* last week, Mr. E. O. Giffard drew attention to the variation of views between the Government and the electricity supply authorities on the siting of nuclear power stations. He said that one argument used by the Central Electricity Generating Board for choosing "remote beauty spots" for these stations was that the Government insisted that for safety reasons they must be placed in sparsely populated areas. The Electricity Board had stated in each case that there was no risk. This letter drew a reply from Sir Christopher Hinton, chairman of the C.E.G.B., who pointed out that the actual statement on the subject in the White Paper on nuclear energy was:—"Nevertheless the first stations, even though they will be of inherently safe design, will not be built in heavily built-up areas." He went on to say that although no risk to health arose from the normal operation of the stations, this did not imply absolute freedom from risk. The plants were so designed and constructed as to give risks smaller than those which normally arose from industry, but as yet there had been little practical experience of operation. He ended:—

> "If human frailty leads to plant failure there must be a possibility that this failure would have effects outside the perimeter of the power plant. The power plants are therefore being built on sites where it would be possible to deal with the results of such an unexpected and improbable occurrence without causing widespread inconvenience."

Extraordinary precautions are plainly essential at present, but it is to be hoped that prolonged experience will show that it will be quite safe to place future stations somewhat nearer the load centres.

* * *

Two or three weeks ago the *Electrical Review* reproduced a picture (with description) of the new armorial bearings of the Central Electricity Generating Board. The March issue of the *Electrical Power Engineer* contains a similar description but adds the following commentary:

> "Our own pet design might have given the shield two less formidable upholders: a stalwart manual worker in nuclear white overalls on the left and a very clever looking engineer, overworked and underpaid, keeping upright the other side. The appropriate and dominant centre piece, in place of the helm, would then have been an accountant's shining top hat."

* * *

Elizabeth Gundrey, editor of the *Shopper's Guide* (Consumer Advisory Council) has been dealing with quality marks in the *Observer*. She says that there are now so many of these marks that confusion is arising in customers' minds. Reference is made to the approval mark applied to solid fuel equipment by the Coal Utilisation Council. This takes the form of a label which is supplied only to "approved" retailers for attaching to appliances, the idea being that such retailers are able to give proper advice and service to customers. The Gas Council, too, has an approval mark which is protected by a checking system both at the point of sale and in the factory. The author concludes with the remark that the electrical industry has nothing comparable with the coal and gas marks. As my readers know, the institution of an approval system for electrical appliances has been under discussion for some time but it is taking rather long to reconcile the views of those concerned.

* * *

The Liverpool City Council Lighting Committee is anxious to complete the conversion of street lighting from gas to electricity in less than the fifteen years originally laid down. This praiseworthy aim was reported by the *Liverpool Daily Post* under the title "Speed-up Urged for Gas Scheme," presumably because "electricity" is too long a word for small headings.

* * *

Frequent breakdowns in a Hampshire area impelled two officials of the Electricity Board to address the parish council in an attempt to explain the cause. Briefly, it was lack of labour and money, which prevented necessary reinforcements being carried out on the distribution system. Nowadays, this is an oft-told tale but it is believed that more funds are becoming available for this work. One of the officials told the Council that in the last eight years consumption in the district had risen by 230 per cent and this was one of the causes of the trouble. That may be true but it is not an explanation likely to satisfy the public. I am fully aware that it is not the fault of the Electricity Boards but the sooner the service can be restored to full reliability the better.

* * *

The status of engineers is a perennial subject of discussion among them and although (as I reported last week) the Lord Chancellor considers that professional engineering is now thought by the public to be as "U" as literary scholarship this is by no means certain. The situation is probably better than it was a half a century ago when the *Electrical Review* (12th March, 1909) complained of the treatment of engineers by those in authority. It was then thought that one cause was that the profession was too easy to enter and not sufficiently self-governed. The *Review* concluded its remarks with the following:—

> "It has been suggested that, following the example of the medical and legal professions, an Engineering Council should be formed, including representatives of all the leading engineering bodies, but otherwise independent of them, and that this authority should be invested with powers analogous to those of the Medical Council and Law Society, in all matters relating to the status, emoluments and etiquette of the engineering profession. The proposition deserves serious consideration."

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

13 A Socket Outlets

IN his letter (*Electrical Review*, 6th March) Mr. D. Barnett Salter complains that his 13 A plugs and sockets overheat and blames it on the design specification. Both B.S. 1363 and B.S. 2814 include tests of temperature rise at 13 A after sufficient time has elapsed for the temperature to become steady; the temperature allowed is 35 deg C. Reputable makes comply comfortably. The "Temco" switched socket shows 23 deg C and the unswitched socket less. Overheating is often traceable to inferior plugs, especially with regard to the fuse contacts.

Mr. Salter has overlooked Supplement No. 1 to B.S. 1363 which does cover surface pattern socket outlets.

Contact along the full length and on all faces of the plug pins as advocated is utterly impracticable and, in any case, it can be proved by test that the reduction in contact resistance would be negligible.

Finally, with regard to wiring space in surface patterns, "Temco" provide approximately ½in for both switched and unswitched types.

London, W.1. S. M. HARRIS,
Director,
T.M.C.-Harwell (Sales), Ltd.

Electrical Manufacturers and Building Costs

I HOPE that Mr. Mortimer Hawkins and I do not really disagree on the role of the architect. Of course electrical services and equipment are so technical that an architect cannot hope to have anything but a nodding acquaintance with them. His main role is certainly the organisation of specialised aspects. Indeed, this was the intention of my opening remarks when I said that he must properly co-ordinate all parts of the building in his design. I did not say that he should design these items himself, for obviously he could not. The matter surely is one of degree.

It may be that all that is needed from the electrical manufacturer about a particular product is the "What it is" paragraph, but the remainder of the general introductory information must be there so that the architect can make a decision with regard to a particular piece of equipment *in relation to the rest of the building*. He, and he alone, can make this decision and therefore to be certain that his compromise between conflicting requirements is the best possible, he must know a little about the subject matter, even if he has to have a specialist to guide him.

On the other hand, if Mr. Mortimer Hawkins is suggesting that all the architect should do is to select the right specialist sub-contractor or engineer and leave it to him, then I must disagree with him. Between one-quarter and one-third of the total cost of most buildings is devoted to the services element and an ever-increasing proportion of this on electrical items.

At the moment an architect is paid a percentage fee on the costs, and on this basis alone one-quarter of his fee should be devoted to the problems involved with the services.

Furthermore, many architects suspect that the services cost far more than they need do. One of the largest architectural practices in the North of England, a very large local authority, and a certain Ministry's Architectural Development Group have proved beyond question that when the architect critically examines his services problems and takes an active part in properly co-ordinating them (which may include collaboration on the "design" aspect of the item), far lower costs, and a more satisfactory functional and æsthetic solution result.

Lee, S.E.12. R. B. HELLARD.

ELECTRIC FLOOR HEATING PRACTICE

The series of five articles on this subject, by Mr. R. D. Jackson, published in the "Electrical Review" during December and January, are now available in booklet form. Applications for copies of the booklet (7s 6d each post free) should be made to the Publisher, "Electrical Review," Dorset House, Stamford Street, London, S.E.1, as soon as possible

Atomic Research at Berkeley

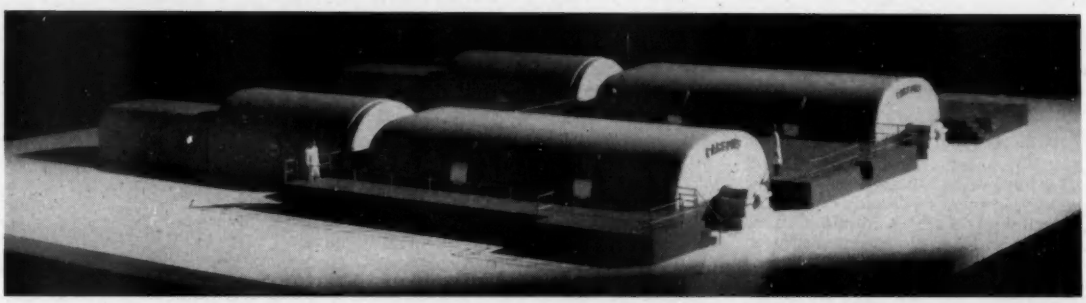
ENGINEERING, physics, metallurgy and chemistry laboratories will form a research centre to be established by the Central Electricity Generating Board near the nuclear power station at Berkeley, Glos. There will be a staff of between 150 and 200, many of whom, it is hoped, will come from local grammar and technical schools and from the universities in the South Western and South Wales area.

Facilities will be available for general engineering development work connected with operating problems arising during the lifetime of the reactors. This may include heat transfer and fluid flow problems, some unit processes in chemical engineering, the development of complicated structures and mechanisms for the study of engineering designs and materials and the study of stresses in massive structures. One of the functions of the laboratory will be to give a constant appraisal of the state of materials used in the construction of the reactors by detailed examination of monitor samples.

In the physical laboratories the physicists and instrument engineers will aim at devising nucleonic instruments to assist in the work of the laboratories and in reactor operations. In addition, considerable experimental studies will result from the programme devised for monitoring the behaviour of the graphite of the reactor core and the problems arising from a study of reactor physics during the commissioning period of reactors and thereafter.

Nuclear Power in British Guiana

Following further discussion, the British Guiana Government has asked the Mitchell Engineering Group, of London, to work out a detailed scheme for the introduction of nuclear power in the colony. Reporting this from Georgetown, Barclays Bank D.C.O. says that the plant involved is expected to cost $15 million. If the Mitchell Group's proposals are fully implemented it will be necessary for the Government to acquire the assets of the Demerara Electric Co., Ltd.



Model of the 500 MW cross-compound turbo-alternator ordered from C. A. Parsons by the Tennessee Valley Authority

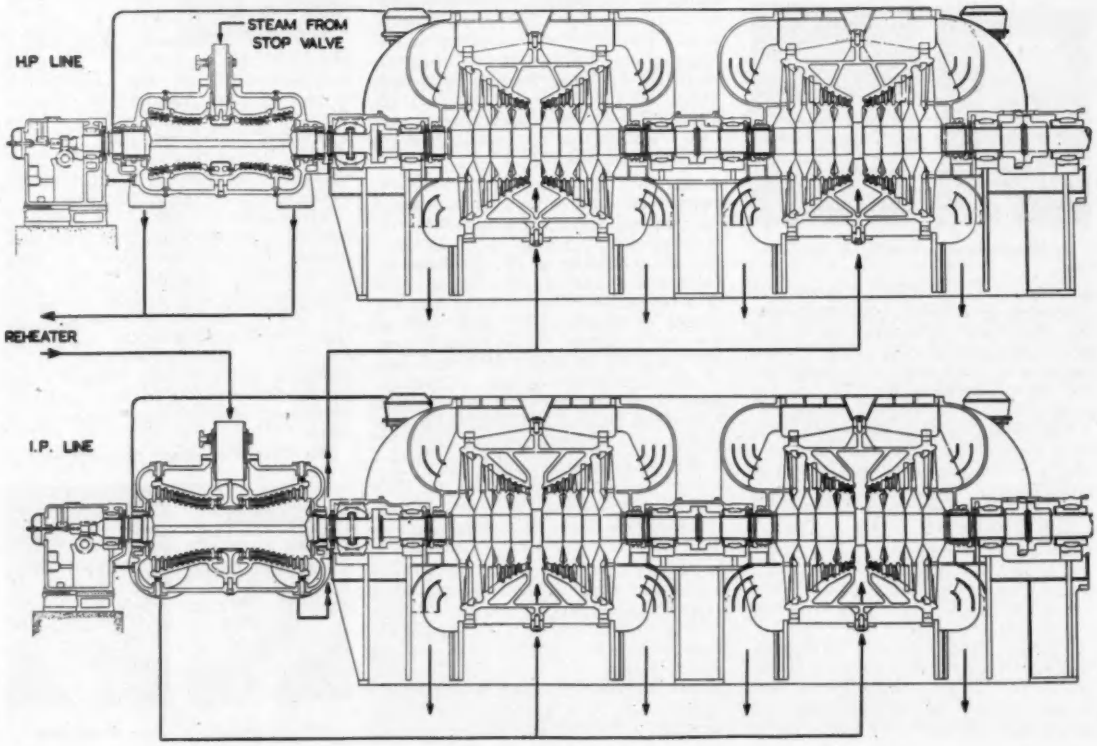
500 MW TURBO-ALTERNATOR FOR T.V.A.

CONTRACT PLACED WITH C. A. PARSONS & CO.

As briefly reported in our issue of 13th February (page 314), a $12 million contract for a 500 MW turbo-alternator has been received from the Tennessee Valley Authority of America by C. A. Parsons & Co., Ltd. The machine will be a cross-compound unit comprising two lines of turbines, each driving a hydrogen and liquid cooled generator at 3,600 r.p.m. and operating with steam conditions of 2,400 p.s.i. and 1,050 deg F with reheat to 1,000 deg F.

Each line of the machine will comprise three double flow turbines. One line will consist of a h.p. turbine and two l.p. turbines, while the second will be made up of one i.p. and two l.p. turbines. Because of the advanced steam conditions, double casing will be provided on both the h.p. and i.p. cylinders. All the turbine shafts will be rigidly coupled including the couplings to the generator rotors. Each of the two generators will be rated at 250 MW, 0·9 p.f., 24 kV, 60 c/s. They will be of hydrogen and liquid cooled design, with rotors of the direct gas cooled type, operating in hydrogen at a pressure of 45 p.s.i. The stator winding will be cooled by liquid circulating through hollow stator conductors.

Schematic diagram indicating the steam flow through the two lines of turbines



PERSONAL AND SOCIAL

News of Men and Women of the Industry

In our last issue we briefly announced the forthcoming retirement on 30th April of **Mr. J. Mould,** O.B.E., A.M.I.E.E., from the chairmanship of the East Midlands Electricity Board, and the appointment of **Mr. N. F. Marsh,** M.A., M.I.E.E., and **Mr. A. H. Kenyon,** M.I.E.E., as chairman and deputy chairman, respectively.

Mr. Mould was appointed deputy chairman of the Board on nationalisation in 1948 and became chairman in 1957. In his earlier days he was assistant to Prof. Silvanus Thompson at the City and Guilds Technical College, and later became generator designer at Siemens Bros. Dynamo Works, Stafford. From 1919 to 1927

Mr. J. Mould

Mr. N. F. Marsh

Mr. A. H. Kenyon

Mr. J. A. MacKerrell

he was deputy chief engineer at Leicester, and from 1927 until joining the East Midlands Electricity Board was general manager and chief engineer of the Leicester undertaking. He was president of the I.M.E.A. for 1939-40.

Mr. Marsh, who succeeded Mr. Mould as deputy chairman of the East Midlands Board in 1957 and who now also follows him as chairman, commenced his career in the electricity supply industry in 1932 as district engineer with the Mid-Lincs. Electric Supply Co., of which he became engineer and manager in 1938, holding this position until nationalisation when he became chief commercial officer of the East Midlands Board. In 1955 he was appointed deputy chairman of the North Eastern Electricity Board, and in 1957 returned to the East Midlands Board as deputy chairman. Mr. Marsh was also formerly a director of the Altrincham Electricity Supply, Ltd., and Public Utilities (Elec.), Ltd., and supervising engineer for the Campbeltown & Mid-Argyll Electric Supply Co. and the Thurso & District Electric Supply Co.

Mr. Kenyon has been sub-area liaison officer of the North Eastern Electricity Board since 1948. After receiving his technical education at Blackburn Technical College and the Manchester College of Technology, and his practical training with Accrington Electricity Department, he became assistant engineer with the Northampton Electric Light & Power Co. in 1929, and in the following year joined the North-Eastern Electric Supply Co., with whom, from 1946 to 1948, he served as administrative assistant to the general manager. Mr. Kenyon was chairman of the North Eastern Centre of the Institution of Electrical Engineers for 1955-56.

Mr. J. A. MacKerrell, F.S.A.A., who, as we reported, is to undertake the duties of Board membership while continuing to serve as a full-time officer, has been the East Midlands Board's secretary since 1956. After local government service from 1922 to 1936 he was appointed secretary of the Institute of Municipal Treasurers and Accountants, a position he held until 1944, when he became secretary of the Incorporated Association of Electrical Power Companies. In 1948 he joined Balfour Beatty & Co. as secretary of Duncan Watson (Electrical Engineers), Ltd., vacating that position in 1956 to join the E.M.E.B.

To mark his completion of thirty years' service for the electricity supply industry, the Eastern Electricity Board at its meeting on 27th February presented to **Alderman W. J. Bennett,** C.B.E., of Tilbury, an illuminated copy of a resolution congratulating him on having completed thirty years' service for the industry. The presentation was made by Sir Henry Self, chairman of the Electricity Council. Alderman Bennett is chairman of the Eastern Electricity Consultative Council and a member of the Board.

Mr. J. J. Gracie, C.B.E., M.I.E.E., a director of the General Electric Co., Ltd., is to receive the honorary degree of Doctor of Laws from Birmingham University at a Congregation in July.

The British Aluminium Co., Ltd., announces that consequent upon the retirement of **Mr. H. W. L. Phillips** in September next, the following staff changes will be made at the Research Laboratories, Chalfont Park, with effect from 12th September. **Mr. A. C. Coates** has been appointed assistant director of research (chemical) and will deputise for Dr. Pearson in the latter's absence. **Mr. P. C. Varley** will become assistant director of research (metallurgical); **Dr. C. E. Ransley** will be given the title of senior research metallurgist; and **Dr. F. A. Champion** will be given the title of senior research chemist.

Mr. L. Malec, M.B.E., has joined the Solartron Electronic Group, Ltd., as managing director of Solartron Radar Simulators, Ltd., which company is responsible for the marketing, building and development of radar simulator systems.

Mr. L. Malec

Mr. Malec, after service in the R.A.F. in the last war, joined British European Airways in charge of all synthetic training equipment and training practice in instrument flying. In 1948 he joined Air Trainers Link, Ltd., and became chief manager in 1950, and managing director in 1953.

Sir Josiah Eccles has accepted the presidency of the A.S.E.E. Golfing Society for the current year.

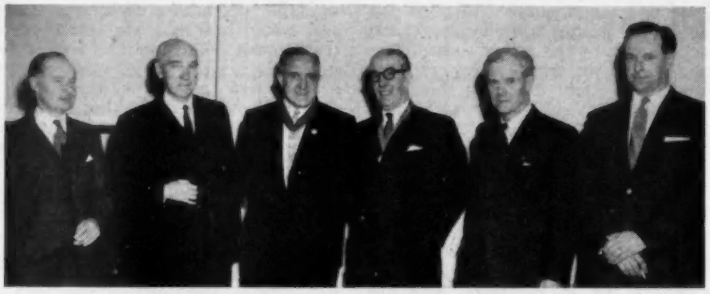
Mr. A. Cormack, B.Sc.(Eng.), Grad.I.Mech.E., formerly assistant superintendent of the Germiston Works of the Metropolitan-Vickers Electrical Co., Ltd., has been appointed superintendent (special duties), Larne Works, and has been succeeded as assistant superintendent at Germiston by **Mr. R. Harrison.**

Mr. Cormack received his technical education at Aberdeen University and joined Metropolitan-Vickers in 1951 as a college apprentice. After his apprenticeship and a short period in the Large Turbine Department, he transferred in 1953 to the company's Germiston Works (Glasgow) as a planning engineer. He became chief production engineer in 1954 and was appointed assistant superintendent in 1956.

Mr. Harrison joined the company as

Mr. A. Cormack

Mr. R. Harrison



At the annual luncheon of the I.E.S. Liverpool Centre, reported in our last issue (p. 435). Left to right: Mr. M. Blackman (secretary), Sir Josiah Eccles (Electricity Council), Mr. C. C. Smith, city lighting engineer, Liverpool (president, I.E.S.), Mr. T. Jones (chairman, Liverpool Centre), Mr. D. H. Kendon (chairman, Merseyside and North Wales Electricity Board) and Mr. J. S. Buck (treasurer, Liverpool Centre)

an apprentice in 1937. Continuing on the manufacturing side he became foreman in the Mechanical Department. In 1952 he transferred to the company's newly opened Germiston Works, where he became general foreman in 1954.

The Board of Trade announces that **Mr. J. C. Duckworth,** B.A., F.Inst.P., A.M.I.E.E., F.Inst.F., will become managing director of the National Research Development Corporation on 1st April next, in succession to **Lord Halsbury,** who, as we have already reported, is joining Lancashire Dynamo Holdings, Ltd., as vice-chairman.

Mr. J. C. Duckworth

After taking first-class honours in physics at Oxford in 1938, Mr. Duckworth played a leading part in radar research and development during the war. After the war he was engaged in fundamental nuclear physics research at Chalk River in Canada and at Harwell, and was later in charge at Ferranti, Ltd., of development and design of the guidance and control system of the guided weapon now known as "Bloodhound." In 1954 he joined the then British Electricity Authority with responsibility for the design, construction and operation of nuclear power stations, and is at present chief research and development officer of the Central Electricity Generating Board.

Mr. D. Hennessey has been appointed by the Corporation to a new post of deputy managing director. He was formerly principal patents officer at the Ministry of Supply. He joined the Corporation's staff in 1950 and was made an executive member of the Corporation in 1956.

Mr. T. A. Noden, an armature winder with Lancashire Dynamo & Crypto, Ltd., since 1900, has just retired after completing the longest continuous service in the history of the company. To mark his retirement, Mr. A. J. Beanland, director and general manager, presented a silver Georgian pint tankard and a cheque to Mr. Noden, whilst his many friends gave him a wallet.

Mr. A. J. C. Smith has retired after 35 years' service with Fuller Electric, Ltd. He has been concerned with the company's sales activities and in recent years has been responsible for coordination of its branch offices. He has been succeeded by **Mr. H. E. Lattin,** who has been with the company since 1936.

Mr. D. C. Underwood has relinquished his position as sales manager of "Davu" Wires & Cables (J. Day & Co. (Derby Works), Ltd.), and in future will operate as an agent for the company in the Eastern Counties areas.

The annual dinner of the **Norfolk Electrical Circle** was held on 4th March at Norwich, Mr. B. H. Robertson, B.Sc., A.M.I.E.E. (chairman), presiding over a gathering of 370. The toast to the electrical industry was proposed by Councillor N. R. Tillett, M.A., LL.B. (Lord Mayor of Norwich), who appealed to the electrical industry to assist in preventing unemployment of teenagers when school-leavers of the "bulge" set out in the world in two years' time. Mr. J. A. Sumner, M.I.E.E., M.I.Mech.E., manager of the Norfolk Sub-Area of the Eastern Electricity Board and president of the Circle, in reply, gave an assurance that everything would be done to place boys leaving school. Had it not been for the Board and an electrical manufacturer, the present sandwich courses for trainees at Norwich would not have materialised. The toast to the ladies was proposed by Mr. H. V. Pugh, A.M.C.T., M.I.E.E., M.I.Mech.E., chairman of the Eastern Electricity Board, and Mrs. Robertson, wife of the chairman of the Circle, replied on behalf of the ladies. Following the dinner there was dancing.

Mr. W. A. May has been appointed a director of Berry's Electric, Ltd., the wholly-owned subsidiary of Berry's Electric Magicoal, Ltd. He retains his position as secretary / accountant of both companies. Educated at Highgate School, Mr. May joined the Sun Insurance Office in 1929 and, after qualifying as a chartered secretary in 1936, joined Berry's in 1937 as a representative until mobilisation of the Auxiliary Air Force. Soon after being invalided from the service in 1943 he was appointed the company's first export manager and became secretary in 1953.

Mr. W. A. May

Mr. H. G. Campbell, managing director of the Benjamin Electric, Ltd., and **Mr. J. O. K. Purdey,** sales director, left London Airport on 4th March for Calcutta. They will be away for two months and in addition to visiting India will also go to Malaya, Australia, New Zealand and the United States.

Mr. D. W. Rippin, M.I.R.E., export manager of Belling & Lee, Ltd., is resigning his position with the com-

At the dinner-dance of the Norfolk Electrical Circle (left to right): The Lady Mayoress of Norwich; Mr. A. J. Barker (Mayor of King's Lynn); Mrs. Barker; Cr. N. R. Tillett (Lord Mayor of Norwich); Mrs. J. A. Sumner; Mr. J. A. Sumner (president); Mrs. B. H. Robertson; and Mr. B. H. Robertson (chairman)

pany and is going to Canada where he will be engaged in a senior sales capacity in the electronics industry with the Astral Electric Co., Ltd., Toronto, who are Belling & Lee, Ltd., Canadian agents. **Mr. J. E. Bailey,** B.Sc.(Elec.Eng.), who has been a technical representative for Belling & Lee, Ltd., for the past two years, has been appointed export manager. Before joining Belling & Lee, Mr. Bailey was with Decca Radar, Ltd., and Marconi's Wireless Telegraph Co., Ltd.

Mr. G. C. Parkinson, who writes in this issue on "The Future of the Cooling Tower" (page 476), joined L. G. Mouchel & Partners in 1927 and held the position of design engineer on projects which included the "Mulberry Harbour" and power stations at home and abroad. In 1948 he was appointed chief engineer of their Cooling Tower Department, and now travels widely in connection with both natural and mechanical draught towers throughout the world.

Mr. G. C. Parkinson

Mr. J. H. Barry has joined Livingston Laboratories, Ltd., as northern field engineer. **Mr. D. D. Arnold,** who has been with the company for many years, is taking over as southern field engineer. **Mr. F. R. G. Webb** has been appointed manager—laboratory services. He was for many years manager of the Test Gear Department of the Plessey Co., Ltd. **Mr. S. W. Urry** becomes manager—field engineering services, and **Mr. H. Sellers** manager—commercial services.

Mr. L. Rotherham, M.Sc., member for research of the Central Electricity Generating Board, has had the title of Fellow of University College conferred upon him by the Senate of London University.

Major-General Sir Francis de Guingand, K.B.E., C.B., D.S.O., and **Mr. E. L. Burton,** B.A., A.C.A., have been appointed to the board of Tube Investments, Ltd. Mr. Burton will continue to be secretary of the company. Sir Francis de Guingand has been in charge of T.I.'s interests in South Africa since 1949.

Mr. Iain M. Stewart, B.Sc., chairman and managing director of Thermotank, Ltd., and **Mr. J. H. Lord,** C.A., a director of the Dunlop Rubber Co., Ltd., have been appointed to the board of G. & J. Weir Holdings, Ltd.

The president, Sir John Hacking, presided at the monthly luncheon meeting of the **Electrical Industries Club** last Tuesday, at which the guest speaker was Mr. Rex Alston, the well-known B.B.C. broadcaster. His amusing reminiscences of his life as a sporting commentator provided an entertaining address which was greatly appreciated by the 150 or so members and guests present. The president announced that the next luncheon would be held on Tuesday, 14th April, and that this would be preceded at 11.45 a.m. by the annual general meeting. He hoped that as many members as possible would endeavour to attend.

Mr. J. F. W. Bowskill has been appointed resident technical representative for South, Central and East Africa for D. Napier & Son, Ltd. He succeeds **Mr. P. S. Deary,** who has been the company's representative for the past four years.

OBITUARY

Mr. W. F. Pearcy.—The Ferguson Radio Corporation announces the death, on 8th March, at the age of fifty-four, of Mr. W. F. Pearcy, who joined the Ferguson Radio Division of Thorn Electrical Industries, Ltd., in 1950 as sales representative for the Surrey-Sussex area. He was previously with Vidor, Ltd.

WILLS

Mr. E. A. Reynolds, M.I.E.E., principal of Reynolds & Bradwell, Ltd., electrical contractors, who died on 17th June last, left £40,302 gross (£37,004 net).

Miss R. Vera Norvick, for many years assistant secretary of the Electrical Association for Women, who died on 1st August last, left £7,900 gross (£7,763 net).

Mr. E. M. Johnson, M.Sc.Tech., M.I.E.E., formerly consultant to the chief electrical engineer of the Metropolitan-Vickers Electrical Co., Ltd., and previously chief engineer of the company's Plant Department, who died on 31st October last, left £9,837 gross (£8,198 net).

Mr. A. S. Dodds, director and London manager of John Thompson Water Tube Boilers, Ltd., and previously with Merz and McLellan, Newcastle-upon-Tyne, who died on 31st October last, left £9,952 gross (£9,766

Clean Air Film

SPEAKING at the Scottish première on 6th March, organised by the South of Scotland Electricity Board, of the film "The Future is Electric," which deals with the subject of electricity's contribution to the clean air problem, Sir John Pickles, chairman of the South of Scotland Electricity Board, said that when the provisions of the Clean Air Act were brought into operation there would be a great demand for smokeless fuel. In Scotland they had the electricity supplies available to meet all the demands. In recent years his Board had published its off-peak tariffs and the Board had been surprised at the development of the use of off-peak electricity for floor-warming. Up to the present floor-warming had been used mainly in schools and commercial premises, but in the South of Scotland there were now over 1,000 houses which used nothing but electricity and there were another 2,000 houses contracted for.

Lord Forbes said that if the aim of the Clean Air Act was to be achieved the public must be persuaded to make greater use of the smokeless fuels available whether for cooking or space and water heating. He commended the Scottish Boards on their enterprise in developing the use of electricity as a smokeless fuel in heating schools, flats and commercial buildings by electrical floor-warming.

The film is in colour and has a running time of 25 minutes. It is available in 16 mm or 35 mm on free loan from the Scottish Boards or from the Electrical Development Association, 2, Savoy Hill, London, W.C.2.

Nickel Alloys

A publication describing the properties and uses of the various grades of nickel-chromium and nickel-chromium-iron alloys manufactured by Henry Wiggin & Co., Ltd., has recently been issued. Materials in the "Brightway" series include electrical resistance alloys for use up to a maximum operating temperature of 1,250 deg C, covering the requirements of many domestic and industrial heating applications. In addition to giving concise data of these alloys, the publication includes sections on materials for leads and connections, furnace elements, thermocouples, etc., forming a guide to the selection of the correct grade of material to meet specific conditions. Copies are obtainable free on request to the Publications Department of the company at 20, Albert Embankment, London, S.E.11.

A private electrical exhibition is to be staged by the company at the Engineering Centre, Birmingham, from 24th to 26th March inclusive. Two sections will deal with, respectively, the properties of nickel alloys and the design of electrical equipment using Wiggin materials. The greater part of the exhibition will show applications and illustrate the many uses of nickel-containing alloys in both the domestic and industrial electrical fields.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £180 0s 0d
COPPER, H.C. Electro	ton £249 5s 0d
Fire Refined 99·70%	ton £248 0s 0d
Fire Refined 99·50%	ton £247 0s 0d
COPPER Tubes ..	lb 2s 4½d
Sheet	ton £278 15s 0d
H.C. wire and strip	ton £296 5s 0d
LEAD, English ..	ton £71 15s 0d
Foreign	ton £70 0s 0d
MERCURY	flask £74 0s 0d
TIN, block (English) ..	ton £776 10s 0d
ZINC, G.O.B. Foreign	ton £75 15s 0d
BRASS Tubes (solid drawn)	lb 1s 11d
Wire	lb 2s 8½d
PHOSPHOR BRONZE Wire	lb 4s 2½d
PLATINUM	oz £28 10s 0d
RUBBER, No. 1 R.S.S. spot	lb 26d—26½d

PARLIAMENTARY REPORT

Coal-Oil Conversions Postponed

AN agreement under which the planned conversion of two further power stations from coal to oil in the 1960s will be postponed for a year was announced in the House of Lords last week by Lord Mills, Minister of Power. This would not only help to reduce our present coal surplus, but it would be of some assistance to the coastal shipping trade, he said. The conversion of two other power stations, due now, would be postponed a further year.

Internal Financing of Capital Investment

Lord Mills was moving the second reading of the Electricity (Borrowing Powers) Bill which has passed the Commons. He defended the supply industry's financial policy, telling the peers that a rising proportion of capital outlay was being financed from the internal resources of the industry. In England and Wales 33 per cent of the capital expenditure in the last ten years came from internal sources, and the estimate over the next seven years was about 46 per cent. In the South of Scotland up to the end of 1957 about 40 per cent of the capital had been so provided; this proportion would fall temporarily because of the large developments now being undertaken but later it was expected to advance beyond 40 per cent. In the case of the North of Scotland Hydro-Electric Board the proportion was much lower, but special considerations applied to the developments there.

In the next seven years nuclear power would absorb nearly 47 per cent of the £1,100 million which the Central Electricity Generating Board proposed to spend on power station construction. At present, said Lord Mills, there were five consortia of firms who had design teams trained by the Atomic Energy Authority. There was in no sense a "closed shop," but a firm which wanted to enter the nuclear field must be prepared to spend a great deal of money on acquiring know-how and in development work before it could expect to see a return. The number of nuclear power stations which would be built in the U.K. before 1966 would not now exceed twelve to fourteen.

Load Factor Improvement

Dealing with electricity supply developments, he said that the adjusted load factor had gone up from 42·7 to 46·8 per cent in the last ten years, and the Electricity Council estimated that the figure would improve to 49·2 in 1964-65. Pumped storage would help the load factor but it was possible only where the configuration of the country was suitable. Many other methods of storage were possible in theory, but none was yet feasible on a commercial scale. Research was continuing, however, and he was satisfied, from what his Scientific Advisory Committee had told him, that the programme was adequate.

Off-Peak Incentives

Lord Ferrier made various interesting suggestions for improving load factor. These included new off-peak tariffs, facilities for all domestic users to obtain thermal storage heaters; lower tariffs for glasshouses, where many horticulturalists were going over to oil; and a special tariff for church heating. He emphasised that a load lost was lost for years. There were over 50,000 churches in Great Britain and if half these were electrified and only averaged 40 kW per installation there was a million kilowatts of load at the week-end to help fill the valley at the bottom of the load curve. Lord Ferrier's last point was that the tariff for railway traction should be cut to minimum, for this would encourage speedy electrification and mean work for a wide range of industries.

Lord Merrivale also asked the Minister to give incentives to attract off-peak consumption. He thought that excellent work was being done by the British Electrical Development Association, although at trade fairs they offered little information or literature about electricity for traction. "This clean, odourless, fumeless and practical form of power deserves effective development and every promotional effort," he declared. The German postal service operated over 1,000 electric vans.

Replying to the debate, Lord Mills said the Boards were now planning to adapt their tariffs to encourage still greater off-peak use which the new bulk supply tariff enabled them to do. The debate had been exhilarating, he said, because of the new ideas put forward and he would certainly commend them to the notice of the electricity authorities. It was not true that thermal storage heaters could not be used domestically; "but they attract purchase tax," he added. "In that respect such representations as I can make I have made."

T.V.A. Contract

Lord Stoneham asked the Government whether they were aware that the General Electric Company of America had asked the U.S. Government to cancel, on grounds of national security, the contract recently awarded by the Tennessee Valley Authority to C. A. Parsons & Co.

Lord Dundee, Minister without Portfolio, said he had no reason to suppose that the award was not firm. The United States Government could be in no doubt about the views of H.M. Government. The T.V.A. had clearly stated that they did not consider that the question of security arose and they were not going to ask for an opinion about it. "The point has been raised in a House of Representatives Committee, but we do not know whether it will reach the floor of the House," he said.

Sir David Eccles gave similar answers when he was questioned by Mr. John Hall in the Commons. But Mr. Hall was not satisfied. He said that, apart from a suggestion that the award of the contract to C. A. Parsons posed a threat to United States national security, it was suggested also that the British firm lacked both the background and the experience to carry out the work. Would the Minister agree that Parsons had much more experience of this kind of work than any of their unsuccessful American competitors, and that they had built and were continuing to build the world's largest generators?

Sir David Eccles said he did not know who the competitors were, but he entirely agreed that the record of C. A. Parsons was second to none.

Transatlantic Telephone Cable Order

Submarine Cables, Ltd., have received an order worth £745,115 from Cable & Wireless, Ltd., for 552 miles of armoured cable for the shallow water section and shore ends of the third transatlantic telephone cable, which will be laid between Scotland and Newfoundland in the summer of 1961. A second order, worth £2,254,400, for 1,600 miles of lightweight cable for the deep-sea section is expected to be placed by Cable & Wireless shortly.

This lightweight cable is of a new type specially developed for use with rigid two-way submerged repeaters of British design. It will provide capacity for sixty simultaneous telephone conversations or forty-eight telegrams in place of any one of them. The ninety-two repeaters which will be required will be ordered later. The total cost of the transatlantic section is estimated at £9 million and it will be shared between Cable & Wireless, Ltd., and the Canadian Overseas Telecommunication Corporation.

The cable will form the first ocean link in the 30,000-mile Commonwealth round-the-world telephone cable, estimated to cost £88 million. The contract for the 480-mile submarine cable link between Newfoundland and the Canadian mainland was placed with Submarine Cables, Ltd., last September.

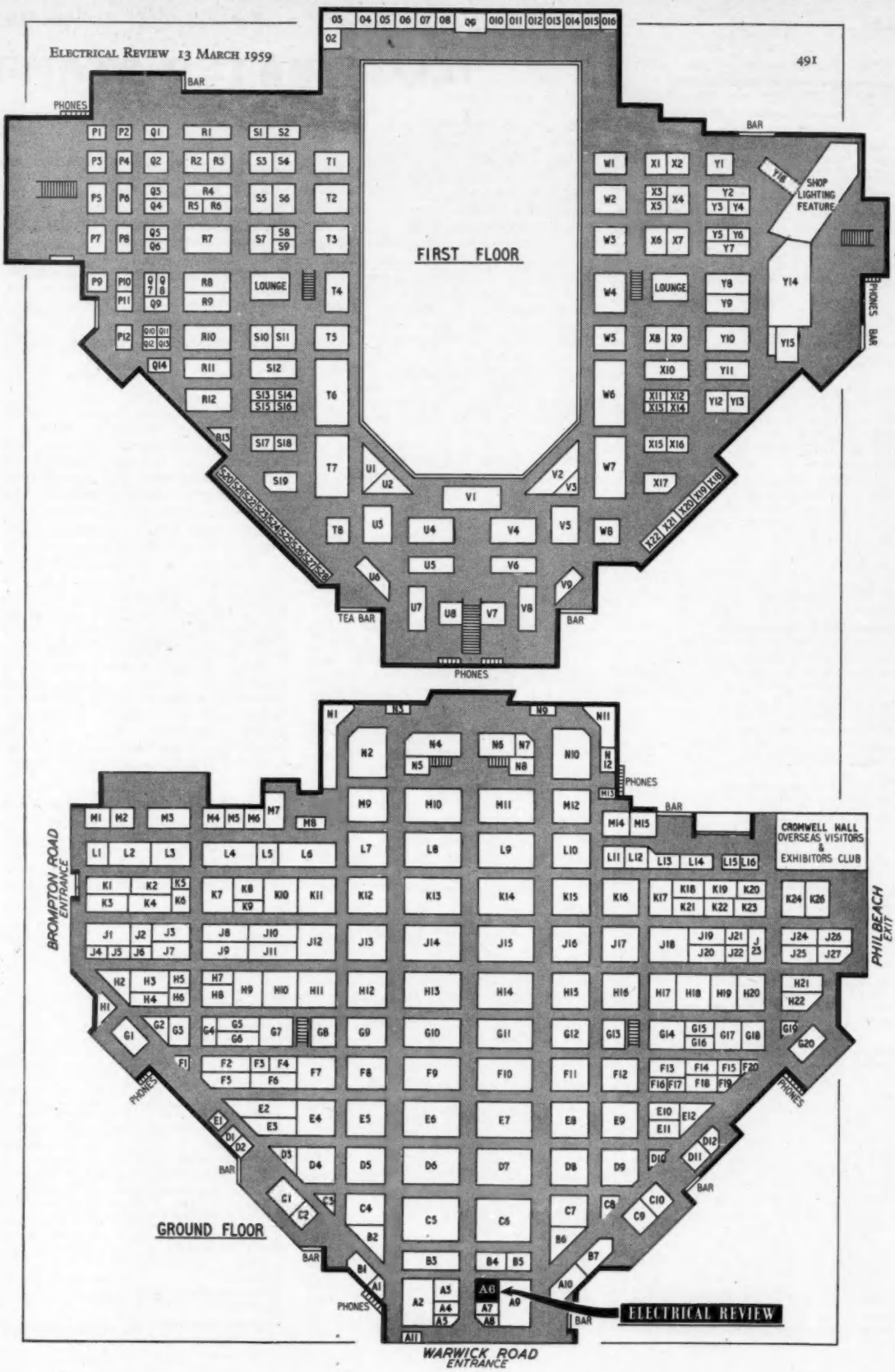
Electrical Engineers' Exhibition

RECORD NUMBER OF MANUFACTURERS AT THIS YEAR'S DISPLAY

OVER 430 electrical manufacturers, associations and other organisations, including more than 50 companies which are exhibiting for the first time, participate in this year's Electrical Engineers' Exhibition to be officially opened by Lord Brabazon at Earls Court, London, next Tuesday, 17th March. The Exhibition, the eighth of its kind, is organised by the Association of Supervising Electrical Engineers and it is estimated that over 40,000 items of electrical equipment will be shown. To mark the jubilee year of the Illuminating Engineering Society there will be a special lighting feature and also a shop window lighting display. "Aurama," a new form of entertainment combining sound, light and movement, will be presented for the first time. After the official opening at noon next Tuesday, the exhibition will be opened on subsequent days until Saturday, 21st March, to the trade only, from 10 a.m. to 7 p.m., except Wednesday, when it will remain open until 9 p.m.

Up-to-date and authoritative books on various aspects of the electrical industry will be displayed on the Electrical Review *stand (A6) and during the course of the exhibition representatives will be available to deal with inquiries.*

Exhibitor	*Stand No.*
Ac-Delco Division of General Motors, Ltd.	G14
A.C. Industries, Ltd.	X11
Ackerley (Benjn.) & Son, Ltd.	S23
Admiralty, The	O4
A.E.I.-Hotpoint, Ltd.	M9
A.E.I. Lamp & Lighting, Ltd.	K14
Aerialite, Ltd.	J13
Agro Electrical Co., Ltd.	C3
Aircraft-Marine Products (Gt. Britain), Ltd.	S6
Aish & Co., Ltd.	X21
Albright (Engineers), Ltd.	R5
Allen West & Co., Ltd.	N2
Alorite, Ltd.	H15
Armstrong Whitworth Aircraft (Sir W. G.), Ltd.	P9
Arrow Electric Switches, Ltd.	H10
Ashcroft Tools, Ltd.	J5
Ashley Accessories, Ltd.	F6
Association of Supervising Electrical Engineers	O9
Astral Equipment, Ltd.	K9
Astral Switchgear, Ltd.	F6
Atlas Lighting, Ltd.	L7
Austinlite, Ltd.	Y14
Automat (Electro Automat), Ltd.	S17
Backer Electric Co., Ltd.	F4
Bakelite, Ltd.	H21
Baldwin Engineering Equipment, Ltd.	G5
Baldwin (H. J.) & Co., Ltd.	G5
Barnsley (John) & Sons, Ltd.	R11
Bayliss, Jones & Bayliss, Ltd.	X8
Beckett & Parker, Ltd.	N12
Belling & Co., Ltd.	U4
Belmos Co., Ltd.	D6
Benjamin Electric, Ltd.	L9
Bertram Thomas (Engineers), Ltd.	N10
Best Products, Ltd.	N7 & 8
Bill Switchgear, Ltd.	C5
B.K.B. Electric Motors, Ltd.	K26
Blackwell (F. C.) & Co., Ltd.	K5
Bolton (Thomas) & Sons, Ltd.	C9
Bonar, Long & Co., Ltd.	X4
Bonnella (D. H.) & Son, Ltd.	X3
Borough Polytechnic	O11
Bourner (F. H.) & Co. (Engineers), Ltd.	N9
Bowker (S. O.) Co., Ltd.	J23
Bowthorpe Electric Co., Ltd.	T6
Bray (E. N.), Ltd.	Y7
Bray (George) & Co., Ltd.	G15
British Central Electrical Co., Ltd.	H17
British Electrical & Allied Industries Research Association	B4
British Electrical Development Association	B5
British Electrical Repairs, Ltd.	F7
British Electric Resistance Co., Ltd.	F19
British Insulated Callender's Cables, Ltd.	P9
British Klockner Switchgear, Ltd.	H15
British Lighting Council	Y18
British Power Transformer Co., Ltd.	F19
British Standards Institution	O5
British Switchgear Corporation, Ltd.	Q11
British Thomson-Houston Co., Ltd.	K14
Britmac Electrical Co., Ltd.	B1
Brook Motors, Ltd.	K16
Brookhirst Igranic, Ltd.	N4 & 5
Brookhirst Switchgear, Ltd.	N4 & 5
Browning's Electric Co., Ltd.	H12
Brush Electrical Engineering Co., Ltd.	C6
Bryce Electric Construction Co., Ltd.	J17
Bullers, Ltd.	X1
Bulpitt & Sons, Ltd.	K26
Burco, Ltd.	X10
Burgess Products Co., Ltd.	M15
Canning (W.) & Co., Ltd.	W2
Carr Fastener Co., Ltd.	X20
Cary (William E.), Ltd.	K6
Cayson Electrics, Ltd.	D3
Central Electricity Generating Board	B3
Chance-Londex, Ltd.	Y14
Chapman & Hall, Ltd.	C8
Chilton Electric Products, Ltd.	J16
Chloride Batteries, Ltd.	K21
Churchouse (C.M.), Ltd.	Y8
C.I.B.A. (A.R.L.), Ltd.	T8
City & Guilds of London Institute	O14
Clang, Ltd.	F5
Clare Instrument Co.	H1
Clarke (H.) & Co. (Manchester), Ltd.	M14
Clifford & Snell, Ltd.	Q14
Cole (E. K.), Ltd.	B2
Collier (J. F.) & Co., Ltd.	D9
Combination Metallic Packing Co. (1921), Ltd.	Y1
Contactum, Ltd.	J21
Controlled Heating Units (London), Ltd.	Q8
Copper Development Association	L11
Courtney, Pope (Electrical), Ltd.	L8
Crabtree (J. A.) & Co., Ltd.	H20
Creators, Ltd.	Q10
Cressall Manufacturing Co., Ltd.	R12
Critchley Bros., Ltd.	R13
Crompton Parkinson, Ltd.	H14
Crossland (R. & A. G.), Ltd.	K19
Croydon Precision Instrument Co.	Y6
Crypton Equipment, Ltd.	E6
Dale Electric (Yorkshire), Ltd.	S11
Davis Sheet Metal Engineering Co., Ltd.	G4
Delta Technical Services, Ltd.	H22
Dennis (G. P.), Ltd.	K17
Dex Industries, Ltd.	M13
"Diamond H" Switches, Ltd.	J2
Dimplex, Ltd.	J8
D.J.V.A. Electrical Systems, Ltd.	S21
Donovan Electrical Co., Ltd.	E3
Dorman & Smith, Ltd.	H15
D.P. Battery, Ltd.	H5
D.R. Illuminations, Ltd.	J13
D.S. Plugs, Ltd.	H15
Dubilier Condenser Co. (1925), Ltd.	L13
Dyson & Co., Enfield (1919), Ltd.	Y9
Easipower Appliances, Ltd.	X5
E.B.E.C.O. Group of Associated Companies	R11
E.C.C. (Moulded Breakers), Ltd.	E8
E.F. Electric, Ltd.	B6
Ega Electric, Ltd.	K18
Ekco-Ensign Electric, Ltd.	C4
Electric & Ordnance Accessories, Ltd.	P8
Electric Construction Co., Ltd.	E8
Electric Transmission, Ltd.	R3
Electric Windings (London), Ltd.	S22
Electrical Apparatus Co., Ltd.	G1
Electrical Association for Women	O10
Electrical Industries Benevolent Association	O8
Electrical Industries Export	A4
Electrical Journal	A7 & 8
Electrical & Radio Trading	A11
Electrical Remote Control Co., Ltd.	M8
Electrical Research Association	B4
Electrical Review	A6
Electrical Times	A3
Electrical Trades Union	O16
Electro Automat, Ltd.	S17
Electro Dynamic Construction Co., Ltd.	J27
Electro Mechanical Manufacturing Co., Ltd.	F2
Electro Methods, Ltd.	L15
Elliott Bros. (London), Ltd.	L14
Ellison (George), Ltd.	L10
Elliston, Evans & Jackson, Ltd.	S27
E.M.B. Co., Ltd.	F17
E.M.P. Electric, Ltd.	U2
E.M.S. Electrical Products, Ltd.	E11
Enfield Cables, Ltd.	J11
Engel & Gibbs, Ltd.	K23
Engelhard Industries, Ltd.—Baker Platinum Division	P6
Engineering & Building Equipment Co., Ltd.	R11
Engineering Industries Association Group Apprenticeship	O15
English Clock Systems, Ltd.	E2
English Electric Co., Ltd.	M11
Erma, Ltd.	S15
Erskine, Heap & Co., Ltd.	A9
Everett, Edgcumbe & Co., Ltd.	D6
Evershed & Vignoles, Ltd.	C1
Expanded Metal Co., Ltd.	R12
Falk, Stadelmann & Co., Ltd.	H13
Fawcett, Preston & Co., Ltd.	X2
Fenton, Byrn & Co., Ltd.	K1
Ferguson Pailin, Ltd.	L6
Ferranti, Ltd.	M10
Fibreglass, Ltd.	S8
Field (H. W.) & Son, Ltd.	Q7
Filhol (J. P.), Ltd.	P2
Fitzgibbon & Murray, Ltd.	E1
Formica, Ltd.	W8
Forrest (George) & Son, Ltd.	L7
Foster Transformers, Ltd.	E6
Founduct, Ltd.	K17
Fractional H.P. Motors, Ltd.	L5
Fraser, Speller Transformers, Ltd.	Q1
Friedland (V. & E.), Ltd.	J3
Fuller Electric, Ltd.	J18
Gatehill Manufacturing Co., Ltd.	Y3
General Electric Co., Ltd.	J15 & V1
G.P.O. Telex Service	V7
Gent & Co., Ltd.	L12
Glover (W. T.) & Co., Ltd.	H9
Greenwood Airvac Conduits, Ltd.	U8
Greenwood & Airvac Ventilating Co., Ltd.	U8
Gulf Oil (Great Britain), Ltd.	G8
G.W.B. Furnaces, Ltd.	F18
Hackbridge & Hewittic Electric Co., Ltd.	N10
Harris & Sheldon (Electrical), Ltd.	H16
Harvey-Slade (Structural), Ltd.	R11
Hawke Cable Glands, Ltd.	S13
Heatovent Electric, Ltd.	K20
Heatrae, Ltd.	M5
Heayberd (F. C.) & Co., Ltd.	S16
Hedin, Ltd.	E10
Heenan & Froude, Ltd.	S7
Hellermann, Ltd.	T6
Henley's (W. T.) Telegraph Works Co., Ltd.	F11
Herman Smith Smithlite, Ltd.	T3
Heyes & Co., Ltd.	Y11
Higgs Motors, Ltd.	D12
Hilmor, Ltd.	L16
Hirst Electronic, Ltd.	J24
Hollman (Oswald), Ltd.	Y13
Holophane, Ltd.	H4
Homeshade, Ltd.	U1
Honeywell Controls, Ltd.	W3
Hoover, Ltd.	V2
Horstmann Gear Co., Ltd.	Y2
Hume Atkins, Ltd.	R6
Hunt (A. H.) (Capacitors), Ltd.	N1
Igranic Electric Co., Ltd.	N4 & 5
Imhof (Alfred), Ltd.	X17
Imperial Chemical Industries, Ltd.	W6
Industrial Tapes, Ltd.	S20
Institution of Electrical Engineers	O7
Instrument Review	A5
Insuloid Manufacturing Co., Ltd.	Q4
Ioco, Ltd.	Y12
Irish Cables, Ltd.	X15
Jackson—Elec. Division of Radiation, Ltd.	W4
Jeary Electrical Co., Ltd.	J9
Johnson (Richard) & Nephew, Ltd.	H11
Johnson & Phillips, Ltd.	C7
Jones & Stevens, Ltd.	S14
Jones (Walter) & Co. (Engineers), Ltd.	X19
Kent Bros. Electric Wire Co. & E. H. Phillips	H3
Kilpatrick (James) & Son, Ltd.	J6
Klockner-Moeller England, Ltd.	W7


FIRST FLOOR
GROUND FLOOR
BAR
PHONES
TEA BAR
LOUNGE
SHOP LIGHTING FEATURE
CROMWELL HALL OVERSEAS VISITORS & EXHIBITORS CLUB
BROMPTON ROAD ENTRANCE
PHILBEACH EXIT
WARWICK ROAD ENTRANCE
ELECTRICAL REVIEW

Exhibitor	Stand No.
Laboratory Equipment (London), Ltd.	S28
Lancashire Dynamo Group	E6, M3 & T1
Langley London, Ltd.	K8
Laurence, Scott & Electromotors, Ltd.	L4
Lee, Guinness, Ltd.	Q9
Lewden Metal Products, Ltd.	G2
Lewy (E. & H.)	R8
Light & Power Accessories Co., Ltd.	G20
Line Equipment, Ltd.	T6
Linolite, Ltd.	X16
Liverpool Electric Cable Co., Ltd.	K10
Lloyds Bank, Ltd.	S9
Lodge Plugs, Ltd.	X21
Londex, Ltd.	G3
London Electric Wire Co. & Smiths, Ltd.	K10
London Fan & Motor Co., Ltd.	V8
London Transformer Products, Ltd.	H19
Long & Crawford, Ltd.	U3
Lord's Controls, Ltd.	X11
Lumitron, Ltd.	S19
Lyon (Arthur) & Co. (Engineers), Ltd.	J25
Machinery Lloyd	A4
Maclaren (Robert) & Co., Ltd.	G18
Magicook Appliances, Ltd.	H6
Magnetic Devices, Ltd.	Q5
Major Equipment Co., Ltd.	H2
Manchester Oil Refinery Group of Companies	S10
Mantel Metalworkers, Ltd.	F13
Marbourn, Ltd.	F1
Marryat & Place, Ltd.	D2
Martindale Electric Co., Ltd.	G6
M. & C. Switchgear, Ltd.	K24
M.C.B. Co. (Manchester), Ltd.	F20
McGeoch (William) & Co., Ltd.	E9
Meritus (Barnet), Ltd.	R1
Metal Industries Group	N4 & 5 & X2
Metropolitan-Vickers Electrical Co., Ltd.	A2
Metway Electrical Industries, Ltd.	N11
Micanite & Insulators Co., Ltd.	T2
Midland Electric Manufacturing Co., Ltd.	D7
Midland Silicones, Ltd.	C10
Millett Levens (Engravers), Ltd.	K10
Minerva Mouldings, Ltd.	M3
M.K. Electric, Ltd.	D5
Morecambe Electrical Equipment Co., Ltd.	T4
Morphy-Richards, Ltd.	K9
M.T.E. Control Gear, Ltd.	H8
Mycalex & T.I.M., Ltd.	J5
Nalder Bros. & Thompson, Ltd.	F12
National Inspection Council for Electrical Installation Contracting	O2
National Pressure Cooker Co. (England), Ltd.	X18
Nettle Accessories, Ltd.	J13
Newman Industries, Ltd.	J1
Nife Batteries	K2
Northern Aluminium Co., Ltd.	Y10
Northern Polytechnic	O13
N.S.F., Ltd.	S2
Otter Controls, Ltd.	X13
Ottermill Switchgear, Ltd.	G9
"P. & B." Engineering Co., Ltd.	V9
Parkinson Cowan Instruments	R4
Parmeko, Ltd.	Q6
Parmiter, Hope & Sugden, Ltd.	D9
Parnall—Electrical Division of Radiation, Ltd.	W4
Partridge, Wilson & Co., Ltd.	H7
Perkins (John M.) & Smith, Ltd.	S26
Permali, Ltd.	N6
Permanoid, Ltd.	F15
Philips Electrical, Ltd.	K13
Pinchin, Johnson & Associaties, Ltd.	V4
Pirelli-General Cable Works, Ltd.	R10
Plessey Co., Ltd.	V5
Poles, Ltd.	M4
Portaway Earthing Equipment, Ltd.	D1
Porter Electrical Products, Ltd.	D1
Power Centre Co., Ltd.	J12
Power Connectors, Ltd.	G16
Preformed Line Materials, Ltd.	S5
Printed Circuits, Ltd.	K10
Pritchett & Gold and E.P.S. Co., Ltd.	M6
Process Control Gear, Ltd.	J4
Pyrotenax, Ltd.	G7
Radiovisor Parent, Ltd.	U7
Ranton & Co., Ltd.	A10
Rawlplug Co., Ltd.	L3
Reason Manufacturing Co., Ltd.	N2
Record Electrical Co., Ltd.	B7
Re-Nu-Aire, Ltd.	Y5
Revo Electric Co., Ltd.	F8
Reyrolle (A.) & Co., Ltd.	H18
Rheostatic Co., Ltd.	M12
Rist's Wires & Cables, Ltd.	R9
Ritchie (Robert) (Electrical), Ltd.	Y4
Robinson (D.) & Co.	Q14
Rolco Engineering, Ltd.	P11
Rosite, Ltd.	V5
Ross, Courtney, Ltd.	S24 & 25
Rowlands Electrical Accessories, Ltd.	D4
Royal Air Force	O3
Sams Electrical London, Ltd.	Q12
Sanders (Wm.) & Co. (Wednesbury), Ltd.	K3
Sangamo Weston, Ltd.	E4
Sankey (Joseph) & Sons, Ltd.	K11
Santon, Ltd.	J20
Sax (Julius) & Co., Ltd.	X9
Scholes (George H.) & Co., Ltd.	D8
Scottish Cables, Ltd.	A1

ILLUSTRATED STAND-

AC-Delco Division of General Motors, Ltd., Dunstable, Beds.—**Stand G.14.**—F.h.p. motors including capacitor start and split phase types, rotor stator units, a.c./d.c. universal motors, and l.v. d.c. motors.

A.E.I.-Hotpoint, Ltd., Grosvenor Gardens, London, S.W.1.—**Stand M.9.**—Domestic appliances include the "Empress," "Countess" and "Princess" washing machines, rotary and table ironers, a portable electric clothes dryer, the new "Pacemaker" refrigerators, "Hi-Speed" kettles, "Super-Smoothwell" electric irons, fires, and convector heaters. Electric water storage heaters, immersion heaters, and the "Twimerser" dual purpose heater for sink or bath form another display.

A.E.I. Lamp & Lighting Co., Ltd., Melton Road, Leicester.—**Stand K.14.**—Among the commercial fluorescent lighting equipment exhibits are bi-pin "Monolux" fittings, two new "Family" diffusers, recessed fittings, and fittings for the new South Bank Shell buildings. The new "Fiesta" range of tungsten lighting fittings is of special interest.

Aerialite, Ltd., Castle Works, Stalybridge, Cheshire.—**Stand J.13.**—A comprehensive range of cables and flexibles for all domestic and industrial power and lighting projects includes "Ashton" v.r.i., t.r.s., and plastic insulated types and special purpose cables. The Aerialite display of flexibles includes "Fariflex," "Floraflex" and "Decorflex" in a variety of colours to match contemporary styling. The "Ashatherm" floor warming system, ring main accessories and a communal "wired" master aerial installation are also shown. Progress in cable design is illustrated by a range of cables for higher temperatures with "Butyl" rubber and high temperature p.v.c. insulation, and by the use of nylon sheaths in place of conventional textile braids.

Agro Electrical Co., Ltd., 60-66, Wardour Street, London, W.1.—**Stand C.3.**—A complete range of polythene (flexible) and Bakelite connector strips from 2 to 30 A capacity in addition to wiring accessories is displayed. Bells, bell transformers, bell pushes, etc., for domestic and industrial purposes are also shown.

Aircraft-Marine Products (G.B.), Ltd., 60, Kingley Street, London, W.1.—**Stand S.6.**—Solderless wiring devices.

Albright (Engineers), Ltd., 125, Red Lion Road, Tolworth, Surrey.—**Stand R.5.**—Solenoid switches and contactors; l.v. and h.v. switches and switch panels; resistors; commutators and sliprings; and new double- and triple-pole relays.

Allen West & Co., Ltd., Brighton, 7.—**Stand N.2.**—Motor starters and accessories for all industrial and flameproof applications are displayed, in addition to crane control gear, automatic multi-motor boards, oil-break hand-operated equipment and class "OB" e.h.v. distribution switchgear.

Alorite, Ltd., Atherton Works, Blackpool Road, Preston, Lancs.—**Stand H.15.**—Examples of the latest ceramic developments together with such exhibits as fuse bodies, insulating beads, insulating materials, and a full range of insulators applicable to many industries.

Sir W. G. Armstrong Whitworth Aircraft, Ltd., Baginton, nr. Coventry, Warwickshire.—**Stand P.9.**—Commercial electronic equipment to be seen on this stand includes a high-speed sampling switch for use in time-

Exhibitor	Stand No.
Shell Chemical Co., Ltd.	X7
Siemens Edison Swan, Ltd.	J14
Siemens Schuckert (G.B.), Ltd.	J17
Sifam Electrical Instrument Co., Ltd.	P4
Simplex Electric Co., Ltd.	F10 & Y15
Simplus Products, Ltd.	S2
S.L.R. Electric, Ltd.	M1
Small Electric Motors, Ltd.	J19
Smith (Frederick) & Co.	K10
Smith Hobson, Ltd.	V3
Smith Meters, Ltd.	P12
Smiths Clocks & Watches, Ltd.	E2
Smiths Industrial Instruments, Ltd.	E2
Sound Diffusion Autothermatic, Ltd.	S4
Sound Diffusion Group	S4
South London Electrical Equipment Co., Ltd.	X12
South Wales Switchgear, Ltd.	K7
Square D, Ltd.	W5
Standard Telephones & Cables, Ltd.	E7
Statter (J. G.) & Co., Ltd.	M3
Sterling Cable Co., Ltd.	W1
Stone-Chance, Ltd.	Y14
Stream Line Filters, Ltd.	X6
Submarine Cables, Ltd.	K12
Sullam (S. D.), Ltd.	Q12
Sumo Pumps, Ltd.	Y14
Suntex Safety Glass Industries, Ltd	P10
Sunvic Controls, Ltd.	G11
Switchgear & Cowans, Ltd.	S12
Switchgear & Equipment, Ltd.	T7
Symons (H. D.) & Co., Ltd.	D11
Synchronome Co., Ltd., The	K4
Synthetic Carbon & Engineering Co., Ltd.	F3

Exhibitor	Stand No.
Tack Air Conditioning, Ltd.	Y5
Tack Development, Ltd.	Y5
Tate Engineers, Ltd.	T6
Taylor (George E.) & Co. (London), Ltd.	F16
Taylor, Tunnicliff & Co., Ltd.	P8
Taylor, Tunnicliff (Refractories), Ltd.	P8
Technograph Electronic Products, Ltd.	Q2
Telcon-Magnetic Cores, Ltd.	K12
Telegraph Construction & Maintenance Co., Ltd.	K12
Tensator, Ltd.	X22
Territorial Army	O6
Tessier (V.), Ltd.	Q13
Tetra Engineering Co., Ltd.	J22
Texas Instruments, Ltd.	S3
Thames Wire & Cable Co., Ltd.	X14
Thermalay, Ltd.	P1
Thermat, Ltd.	G5
Thermodare (Great Britain)	M2
Thermostatic Controls Co.	Q8
Thomas (Frederick) & Co., Ltd.	U6
Thorn Electrical Industries, Ltd.	L7
Thorpe (F. W.), Ltd.	J7
T.M.C.-Harwell (Sales), Ltd.	C2
Trade Intelligence, Ltd.	A4
Transformers (Watford), Ltd.	P5
Tricity Cookers, Ltd.	L7
Troughton & Young, Ltd.	G12
Tudor Accumulator Co., Ltd.	H5
Tufnol, Ltd.	K15
Turners Asbestos Cement Co., Ltd.	T5
Tyrad Electric, Ltd.	G12
Ucan Developments, Ltd.	N3

BY-STAND PREVIEW

division telemetry systems; a 460 Mc/s precision oscillator; a 70 mm recording camera developed for recording high-speed transient phenomena found in missile telemetry; a wobbulator and i.f. test set giving direct calibration of frequency and relative response in the frequency range 10-220 Mc/s; a transistor galvanometer amplifier; and a directional coupler of the loop type.

Arrow Electric Switches, Ltd., Hanger Lane, Ealing, London, W.5.—**Stand H.10.**—The comprehensive range of "Arrow" switches is extended to include types specially designed for washing machine and spin dryer applications, and in the field of multi-circuit packet switches, 100 and 200 A sizes are added to the 10 and 30 A types offered last year. The company's range of motor control gear, comprising magnetic contactors, starters, relays and multi-circuit relays, with enclosed and unenclosed push-buttons, now includes a new range of isolators and oil-tight push-button stations and controls.

Ashley Accessories, Ltd., Ulverston, Lancs.—**Stand F.6.**—13 A sockets and switched socket-outlets; fused plugs including high-impact types; 13 A socket adaptors; and selective entry spur junction boxes.

Astral Switchgear, Ltd., Alma Road, Enfield, Middlesex.—**Stand F.6.**—A new 30 A a.c./d.c. composite switch fuse for switchboards; a recently introduced range of standard apparatus enclosures; a cubicle and unit switchboard carrying "Astral" fused switches; representative examples of special sheet steel enclosures; busbar chambers (100-500 A range); multi-way terminal assemblies; also examples of standard heavy-duty adaptable boxes.

Atlas Lighting, Ltd., 233, Shaftesbury Avenue, London, W.C.2.—**Stand L.7.**—Emphasis is placed on the "Atlantic" range of fluorescent lighting fittings. A new ceiling system accommodates all lighting and power services and carries office structure partitioning.

Backer Electric Co., Ltd., Rotherham, Yorks.—**Stand F.4.**—Tubular sheathed elements in sizes from ¼ to ⅜in diameter for most heating applications. New products include shop window demisters.

Bakelite, Ltd., 12-18, Grosvenor Gardens, London, S.W.1.—**Stand H.21.**—Compregnated wood, a heavy duty material for industrial insulation work, and a range of glass laminates based on epoxide, silicone, melamine and phenolic resin are among the products exhibited.

H. J. Baldwin & Co., Ltd., 132, Arkwright Street, Nottingham.—**Stand G.5.**—A representative selection of the company's self-locking cable protection covers, stoneware conduits, joint boxes, concrete products, reconstructed stone and unit construction fencing is shown. "Duratube" plastic covered wires and cables and "Wireohms" heating elements are also displayed, as well as "Octopus/Octoflex" electric wiring systems. The Domestic Appliance Division is showing "Thermat" electric blankets and a range of kettles and immersion heaters.

Bayliss, Jones & Bayliss, Ltd., Victoria Works, Wolverhampton.—**Stand X.8.**—Transmission line steelwork for h.v. and l.v. systems and telecommunications.

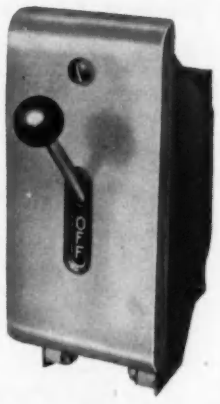
Beckett & Parker, Ltd., 157-159, Summer Lane, Birmingham, 19.—**Stand N.12.**—On show are new relay meters. These consist of normal 6in moving iron or moving coil instruments so arranged that a very light shutter attached to the pointer interrupts a light-beam focused on to a photo-transistor, the current from which operates a relay direct. The position of the light source and photo-transistor can be adjusted to any point on the instrument scale. Flameproof and other instruments, including open dial types with moving coil or moving iron movements, are also displayed.

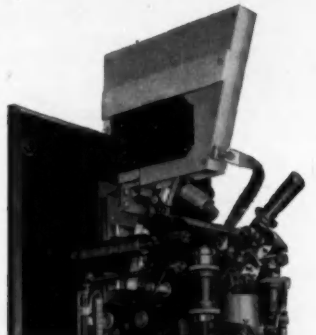
Belling & Co., Ltd., Bridge Works, Southbury Road, Enfield.—**Stand U.4.**—Among the company's range of electric fires, convectors and cookers are several new models, including the "Belray" infra-red heater; the "Zenith" convector with three-heat control; and "Beacon" reflector fires. Clothes drying cabinets, towel airers, food cabinets, etc., are also shown.

Belmos Co., Ltd., Bellshill, Lanarkshire.—**Stand D.6.**—A range of a.c. motor control gear and switchgear for flameproof and industrial use; multi-tier control boards comprising cubicle units; a newly-designed 8-tier housing accommodating 15 A plug-in contactors, with individual isolation; latched contactors, and control boards designed to withstand 25 and 35 MVA faults; and a 3·3 kV contactor starter for a 500 h.p. motor. The main feature of the flameproof exhibits is a switchboard consisting of a circuit-breaker, starter, drill control unit, and lighting transformer, to N.C.B. standard specifications.

Benjamin Electric Co., Ltd., Brantwood Road, Tottenham, London, N.17.—**Stand L.9.**—The "Taskmaster" range of "Flurolier" fittings and "Model Fifty" reflectors and fittings are of special interest. Enclosed area floodlights for raising and lowering gear are shown for the first time and other products include fittings for industrial, commercial and outdoor use, the majority being finished in "Crysteel" vitreous enamel.

Exhibitor	Stand No.
Uni-Tubes, Ltd.	D10
Vactite Wire Co., Ltd.	K10
Vanguard Engineering Co.	M7
Varilectric, Ltd.	G13
Venner, Ltd.	L1
Vent-Axia, Ltd.	U5
Vernons Industries, Ltd.	R7
V.G. Porcelain Co., Ltd.	F6
Vokes, Ltd.	X6
Vokes Genspring, Ltd.	X6
Walker (W. G.) & Co. (Engineers), Ltd.	K6
Wallacetown Engineering Co., Ltd.	V6
Walsall Conduits, Ltd.	E5
Wandleside Cable Works, Ltd.	X15
Wandleside Warren Wire, Ltd.	X15
Wandsworth Electrical Manufacturing Co., Ltd.	E12
Wardle Engineering Co., Ltd.	R2
Watford Electric & Manufacturing Co., Ltd.	L2
Watliff Co., Ltd.	K22
Westinghouse Brake & Signal Co., Ltd.	G10
Westwood Switchgear, Ltd.	H2
Whipp & Bourne, Ltd.	J26
White (William) (Switchgear), Ltd.	F14
Wilcox (Edward) & Co., Ltd.	S18
Wimbledon Polytechnic	Q12
Wire Products & Machine Design, Ltd.	G19
Wireohms, Ltd.	G5
Woden Transformer Co., Ltd.	J10
Yorkshire Switchgear & Engineering Co., Ltd.	G1
Zenith Electric Co., Ltd.	Q3





Above: 30 A a.c./d.c. composite switch fuse for switchboards (Astral Switchgear). Right: Semi-high speed rectifier circuit-breaker (Bertram Thomas (Engineers), Ltd.)

Bertram Thomas (Engineers), Ltd., Worsley Street, Hulme, Manchester, 15.—**Stand N.10.**—On this stand are medium voltage a.c. airbreak circuit-breakers; high-speed and semi-high-speed circuit-breakers; electric buffets; tubular heaters; and "Tiltrack" storage equipment for the electrical and allied industries. A new departure for the company is a totally enclosed, dead-front d.c. switchboard, complete with horizontally-withdrawable 800 A semi-high-speed circuit-breakers and isolator.

Best Products, Ltd., Felix Works, Felixstowe, Suffolk.—**Stands N.7 & 8.**—New appliances shown for the first time include the "Warwick" coffee percolator, in a highly glazed ceramic finish, fitted with an automatic element incorporating a thermal safety device. The capacity is from 1½ to 2½ pints maximum and it is offered in a range of five colours. Two new spin dryers, the "Bambino" (6½ lb dry weight of clothes) and the "Felix" (8¼ lb) are also on view. Electric kettles, electric blankets, an electric mattress overlay, and a selection of elements complete the domestic display.

Bill Switchgear, Ltd., Aston Lane, Perry Barr, Birmingham, 20.—**Stand C.5.**—A representative selection of l.v. switch and fusegear on display includes switches, switchfuses, and fuse distribution boards for industrial and domestic purposes. The range of "Majestic" distribution boards has now been extended to include units of heavier rating and additional fuse ways. A new series of 4-pole change-over switches from 15 to 60 A is shown and the "Consul" range of change-over switches has been extended to incorporate 100 and 160 A units. An improvement in "Majestic" cubicle switchboards is the introduction of retractable handles on the fuse-switch units. "Majestic" cubicle switches are now available as separate units and there is a new 60 A cooker switch with 13 or 15 A kettle circuit. To control off-peak-tariff loads for thermal storage, floor warming, space and water heating installations a new range of "Civic" control units has been developed. "Vertex" distribution boards fitted with miniature circuit-breakers are on view for the first time.

Bill Switchgear "Civic" control units for the control of off-peak-tariff loads

F. C. Blackwell & Co., Ltd., Great Crosby, Liverpool, 23.—**Stand K.5.**—In addition to the range of "Blaco" conduit fittings and switch boxes, a range of boxes for mineral insulated cable with patent clamps for the sheath and dispensing with screwed glands is introduced. Other exhibits include a continuity junction box for pre-cast concrete floors; a new thermo-couple junction box with patent connectors of special interest to instrument makers; a series of insulated adjustable lug switch or socket boxes in plaster depth, 1- and 2-gang; and special switch or socket boxes for dry partition walls.

Thomas Bolton & Sons, Ltd., Mersey Copper Works, Widnes, Lancs.—**Stand C.9.**—High conductivity copper for all electrical purposes in the form of wire and strand, bar and rod, sheet, strip and foil, busbars, commutators and other sections, and tubes. Facilities are available in the company's works for bending, sawing, drilling, slotting and tinning busbars to customers' requirements.

Bonar, Long & Co., Ltd., East Kingsway Works, Dundee.—**Stand X.4.**—Examples of outdoor distribution pillars (tail and tailless) incorporating transformer units up to 1,600 A and distribution units of 400 and 600 A are shown. A special feature is the pole-operated contact clamped isolator. Also on view are indoor substation distribution boards incorporating transformer units up to 2,000 A; a 15 kVA pole mounting 11,000/500-250 V transformer with h.v. and l.v. bushings; flameproof capacitors suitable for use on systems up to 3·3 kV; and unit type capacitors. A new range of combination fuse-switch units covering a range of fusing up to 800 A is shown for the first time.

D. H. Bonnella & Son, Ltd., West Hill, Hoddesdon, Herts.—**Stand X.3.**—Laminated and moulded switches for domestic and industrial appliances, small motors and portable tools, instruments, and electronic equipment.

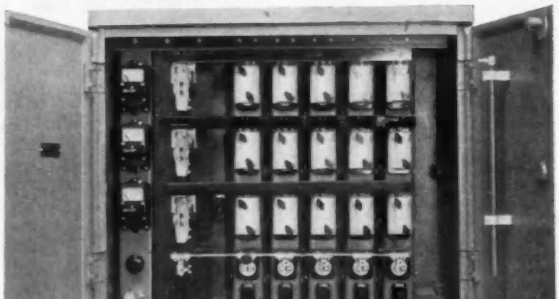
F. H. Bourner & Co. (Engineers), Ltd., Manor Royal, Crawley, Sussex.—**Stand N.9.**—A new model of the Mark IV "Supadynamic" cartridge operated fixing tool is demonstrated. Breech loading is employed to speed up operations and other new features include a silencer so that this tool may be used in circumstances where others would be prohibited. In addition, the company is exhibiting the "Supadrive" and "Supadrive Minor," both hammer operated tools that can be carried in the overall pocket.

S. O. Bowker, Ltd., 19, Warstone Lane, Birmingham, 18.—**Stand J.23.**—Electrical wiring accessories include a new range of a.c. plate switches, grid switches and 13 A sockets and switched sockets.

Bowthorpe Electric Co., Ltd., Crawley, Sussex.—**Stand T.6.**—A complete range of overhead line fittings comprising nut types for aluminium and copper conductors, also insulating shrouds, insulated line taps and modified types suitable for use in floor warming and industrial heating systems. Specimen poles show the effect of the company's pole preservation treatment and there is also a selection of linesmen's tools including new assemblies designed to ensure safety. Another new product is the "Anchorgrip" earthing clamp for domestic and industrial earthing purposes.

E. N. Bray, Ltd., Britannia Road, Waltham Cross, Herts.—**Stand Y.7.**—A representative selection of the company's products includes control and general purpose relays of various ratings and types; thermal and magnetic overload relays; timing relays; standard contactors from 15 to 300 A and special contactors up to 1,500 A; marine and industrial motor control gear; hand and motor operated rheostats; and accessories including limit and foot switches, pressure switches, push buttons, etc.

Geo. Bray & Co., Ltd., Leicester Place, Leeds, 2.—**Stand G.15.**—Strip,



Outdoor distribution pillar (Bonar, Long & Co., Ltd.)

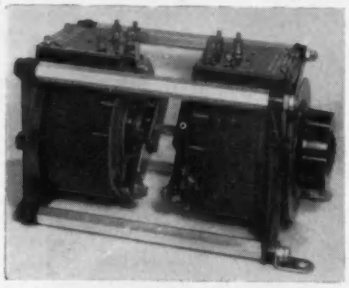
ring and cartridge elements, for any application up to 1,000 deg F, and heating elements for commercial needs are shown. Another section of the stand is devoted to electro-ceramics and fine extruded work.

British Central Electrical Co., Ltd., 6 & 8, Rosebery Avenue, London, E.C.1. — **Stand H.17.** — Fluorescent lamps and lighting fittings; cable trunking; "Gripper" handlamps for mains and l.v. supplies; fluorescent handlamps; flameproof portable barrel pumps; miniature circuit-breakers; bench and drawing board lighting units; switch sockets and plugs; loop impedance tester; cargo lighting units; the "Lumundar" lighting control unit (will break 10 A direct and operated from any light source); and infra-red heaters. New products include the "Briticent" micro-sonde unit which comprises a minute infra-red sensitive cell and a control unit, using a thyratron operated relay. Actuated from any light source, the unit will count at the rate of 900 per minute, control levels of liquids, etc., and form the nerve centre for alarm and indicating systems. There is also a new 4-way, 5 A socket outlet, an unbreakable unit comprising four 5 A sockets moulded in solid rubber or neoprene. Sockets are formed from continuous brass strip which is recessed in channels in the base.

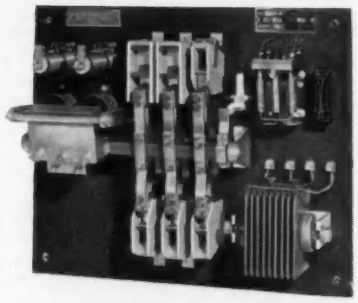
British Electric Resistance Co., Ltd., Queensway, Enfield, Middlesex.—**Stand F.19.**—The main theme of the display of this company and its associate, the British Power Transformer Co., Ltd., is variable transformers in various forms. These include the rotary "Regavolt" range of toroidally wound units from 250 VA to 2·5 kVA rating single-phase for hand operation and with motor drive, and in single- and three-phase designs. An example of a new range of heavy duty regulators in a series of standard sizes ranging from 15 kVA to about 300 kVA three-phase for furnace control, plating applications and similar industrial uses is on view. Among other exhibits are industrial unbreakable grid resistors; vitreous enamelled resistances; sliding resistances; and two additions to the range of toroidally wound rheostats.

British Electrical Development Association, 2, Savoy Hill, London, W.C.2.—**Stand B.5.**—With "Electronics—the Key to Automation" as the theme, this exhibit illustrates the advantages to industry arising from the greater use of electronic control, and the introduction of automation. Examples of automatic equipment include an electronically controlled conveyor, a model of a driverless electrically-powered works truck which follows a predetermined route, and equipment for the automatic assembly and soldering of printed wiring circuits.

British Electrical Repairs, Ltd., 10, Charlotte Street, Manchester, 1.—**Stand F.7.**—A wide variety of items



A typical rotary "Regavolt" unit (British Electric Resistance Co., Ltd.)



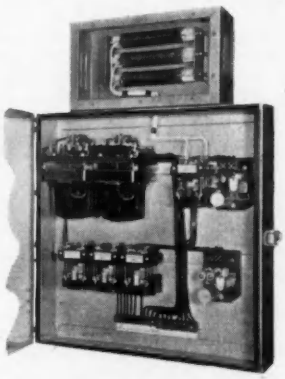
A type 2B, 30 A change-over contactor (E. N. Bray, Ltd.)

associated with electrical plant repairs are represented by typical examples of large, medium, and small coils, including hot mica wrapped and hot and cold pressed armature coils for service on moderate and very high voltages; a 3-phase 3,300 V, 12-pole stator winding, typical of windings manufactured for export; a large diameter commutator; various segments; and collector rings. The winding of small double evolute armature coils for aircraft generators and the dynamic balancing of rotating parts is demonstrated.

British Insulated Callender's Cables, Ltd., Norfolk House, Norfolk Street, London, W.C.2.—**Stand F.9.**—P.i. transmission and distribution cables include low, medium and high voltage types. A special feature is made of the company's new 33 kV mass-impregnated non-draining cable and the 11 kV polythene insulated p.v.c. sheathed aerial power cable. Rubber cables and flexibles include h.v. power cables, unarmoured and armoured; railway cables; ship wiring cables; aircraft cables; domestic and industrial flexibles; and mining cables. Cabled copper tube, plastic cables and flexibles, winding wires and strips, and mineral insulated cables and accessories are also shown in addition to overhead line equipment. Products of the company's Heating Division are represented in the form of "Panelec" floor warming systems and heating cables. Models feature alternative low temperature radiant warming systems suitable for off-peak operation.

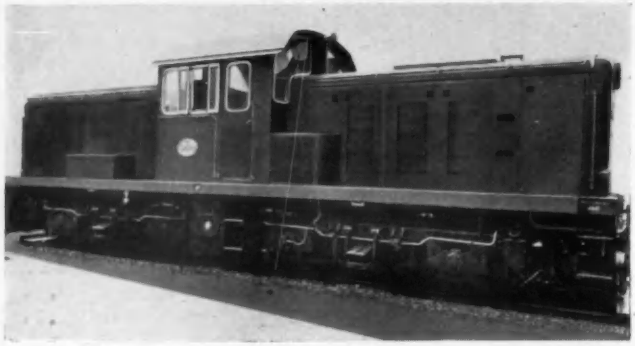
A selection of heating elements manufactured by Geo. Bray & Co., Ltd.

British Central Electrical Co.'s 4-way 5 A moulded rubber socket outlet



Automatic lift control panel for 15 h.p. slip-ring motor (British Klockner)

British Klockner Switchgear, Ltd., Chertsey, Surrey.—**Stand H.15.**—Automatic control panels built to consumers' own requirements are shown. Special emphasis is placed on panels for heat distribution control and automatic lift control panels. The panels are made for motors up to 15 h.p. direct-on-line or 25 h.p. auto stator-rotor starting, also for small passenger or industrial lift controllers, suitable for motors starting direct-on-line up to 2 h.p. on 380/440 V, 3-phase, or



40 ton, 400 h.p. diesel-electric locomotive of the type being supplied by the British Thomson-Houston Co., Ltd., to New Zealand

½ h.p. on 200/250 V, single-phase. Electrical control equipment includes d.o.l. starters, reversing starters, auto star-delta starters, 2-speed motor starters, auto transformer starters, auto stator-rotor starters, contactors, thermal overload units, push-button and remote control stations, limit switches and rotary switches.

British Switchgear Corporation, Ltd., Morden Factory Estate, Lombard Road, London, S.W.19.—**Stand Q.11.**—H.v. switch and fusegear; knife switches; terminal blocks; l.v. isolating switches; flameproof circuit-breakers; and all types and sizes of solderless busbar and cable connectors.

British Thomson-Houston Co., Ltd., Rugby.—**Stand K.14.**—In addition to a 40 ton 400 h.p. diesel-electric locomotive (on display in front of the Exhibition Hall) the company's exhibits include electric motors, control gear, switchgear, and semiconductor and electronic apparatus. The locomotive is one of eighteen being supplied by the company to New Zealand and is of the double-ended bonnet type, with a maximum tractive effort of 22,500 lb and suitable for speeds up to 40 m.p.h. Switchgear is represented by a 400 A 11 kV metal-clad oil-break vertical-plugging equipment and a three-phase automatic circuit recloser (Type RB) for the improved continuity of supply on rural lines up to 11 kV. Developments in electronic engineering are represented by a type FV44 transistor voltage regulator and a working exhibit of a type FW51 synchronous welding control equipment. The voltage regulator is designed primarily for use with single unit self-contained alternators rated at up to 100 kVA, 50-60 c/s, and automatically controls the alternator voltage to within ±1 per cent of its rated value. The wide range of electric motors is exemplified by B.S. dimension machines, including totally-enclosed and ventilated types.

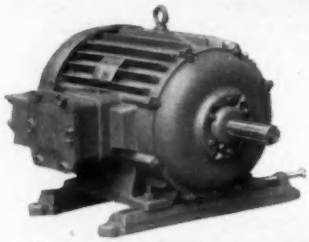
Variable-speed a.c. motors are shown operating. Industrial control gear covers d.o.l. contactor starters; star delta, hand operated and contactor starters up to 50 h.p.; as well as push-buttons, limit switches, control switches, pressure switches, float switches, time delay relays and safety lighting sets, and a multi-motor control centre of new design (Series 1,000), with plug-in feature, and requiring the minimum of floor space. In the semiconductor power rectifier field the A.E.I. Heavy Plant Division is showing cell-and-fin assemblies, typical stacks built from these assemblies, and complete rectifier equipments incorporating such stacks.

Britmac Electrical Co., Ltd., 121, Victoria Street, London, S.W.1.—**Stand B.1.**—A display of electrical accessories includes the new "Flip-Flap" rocker dolly switches in Bakelite and metal. The Bakelite pattern is available with up to four switches arranged in a 2-gang box, while the metal pattern, developed particularly for hospital use, is available with metal or Bakelite dolly in various finishes and in units combining up to twelve switches. Non-standard fused plugs and sockets and mercury sparkless switches and switch sockets from 5 to 60 A are also shown.

Brookhirst Igranic, Ltd., Bedford.—**Stand N.4.**—For the first time since their recently announced merger, the two electric control gear companies in the Metal Industries Group, Brookhirst Switchgear, Ltd., and Igranic Electric Co., Ltd., exhibit on a joint stand. Among new Brookhirst products is static control equipment consisting of small block units, entirely devoid of contacts and moving parts, which replace conventional auxiliary controls. Additional fittings for 25 and 50 A "Arcmaster" contactors exhibited for the first time include latch-in mechanism, mechanical interlock, d.c. magnet, mechanical indicator, and "Trulag" timing relay. Typical switchboards are shown comprising starter units of swing-out, draw-out and plug-in type.

Among Igranic exhibits is a magnetic amplifier drive for a f.h.p. motor, working through a clutch, demonstrating the stability of the system under conditions of variable load. Crane hoist and travel control panels, using block contactors, show that the company are now providing control panels of smaller dimensions than before, and for medium and smaller size cranes. The new "Lo-vo-lite" makes its first appearance with redesigned transformer switch-fuse unit and improved lighting fitting. There is also a selection of Igranic master, limit, pressure and float switches, and of solenoids and solenoid-operated brakes.

Brook Motors, Ltd., Empress Works, Huddersfield.—**Stand K.16.**—A new flameproof fan-cooled motor forms the chief exhibit. Specially developed for continuous operation in the presence of inflammable gases or dusts, it is particularly suitable for use in the petroleum, chemical and coal mining industries. The flameproof construction is to B.S. 229 : 1957 for Groups 1, 2 and 3 gases. Special features of the



Brook Motors new flameproof motor for Groups 1, 2 and 3 gases

motor are metal to metal casing joints; cartridge bearing housings fitted as standard; rotor completely removable without exposing bearing to dust; and isolated endshield cavities. The "C" type ventilated motor, to B.S. 2960, is shown in sizes from ½ to 50 h.p. and fan-cooled motors, to B.S. 2083 : 1954, from ¼ to 50 h.p. Other new exhibits include 75 A contactors to B.S. 587 and B.S. 775 for use with motors up to 50 h.p. and the "LSD" 50 A starter for motors up to 30 h.p. A full range of f.h.p. motors in various enclosures for industrial, domestic and light applications is shown, along with a new range of M66 motors, which are similar to the "Merlin" range but of larger size.

Browning's Electric Co., Ltd., Boleyn Castle, Green Street, Upton Park, London, E.13.—**Stand H.12.**—Among this company's exhibits are f.h.p. motors for special applications; commutators; slip rings; commutator turning and undercutting machines; actuators (maximum torque 300 lb-ft or maximum 2½ tons thrust); electric soldering irons; and production winding.

Brush Electrical Engineering Co., Ltd., Loughborough.—**Stand C.6.**—Steam and gas expansion turbines, turbo-alternator sets, power and distribution transformers, on-load tap-changing gear, a.c. and d.c. motors and generators, h.v. and l.v. switchgear, distribution gear, fusegear, h.r.c. fuses, locomotives and traction equipment are among the products of this

company. A range of motors available in sizes up to 5,000 h.p. is represented by several types, including a 400 h.p., 3·3 kV, overhung salient-pole synchronous motor and a 45 h.p. 500/550 V totally enclosed fan-cooled flameproof induction motor for armoured conveyor drive. Among generator exhibits is a complete rotor and exciter armature for a 2,500 kVA salient-pole alternator. The Transformer Division is exhibiting a flameproof dry type mining transformer, capacity 300 kVA, voltage ratio 3,300/565 V, 3-phase, 50 c/s. A type "OVB" outdoor metalclad oil circuit-breaker unit suitable for use on three-phase systems is shown by the Switchgear Division. Also on show is a 200 h.p. Ward-Leonard control unit.

Bryce 70 kVAr 3-phase 50 c/s 550 V mining type capacitor fitted with flameproof contactor panels

Bryce Electric Construction Co., Ltd., Kelvin Works, Hackbridge, Wallington, Surrey.—**Stand J.17.**—From the company's transformer range which extends to 20 MVA at 132 kV there are a 2,000 kVA, 6,600/3,465 V, 3-phase, 50 c/s transformer removed from its tank to enable close inspection of constructional details; and a 200 kVA Class "C" transformer insulated with silicone impregnated materials, one of a new series exhibited for the first time. A 1,500 kVA current limiting reactor of the magnetically shielded type is also shown removed from its oil-filled tank. Capacitor exhibits include a 70 kVAr, 3-phase, 550 V mining capacitor fitted with a flameproof contactor, and a 75 kVAr, 3-phase 6,900 V pole-mounting capacitor battery suitable for tropical installation.

Bullers, Ltd., Milton, Stoke-on-Trent.—**Stand X.1.**—Insulators and fittings for overhead lines of all kinds from telephone and l.v. distribution to 380 kV; post type insulators for switchgear; fitted bushing insulators up to 33 kV; and large porcelains for bushings and air blast switchgear up to 330 kV. The outdoor end porcelain bushing supplied to the B.T.H. for the 330 kV circuit-breakers for the Kariba hydro-electric scheme is also being shown.

Bulpitt & Sons, Ltd., 132, Icknield Street, Birmingham, 18.—**Stand K.26.**—Domestic electrical appliances including kettles, coffee percolators, toasters, blankets and ground-base aluminium holloware.

B.K.B. Electric Motors, Ltd., an associated company, have on view a wide range of single-phase motors from ½ to 3 h.p.; three-phase motors from ½ to 7½ h.p.; d.c. motors from ½ to 25 h.p.; and a.c. and d.c. generators up to 30 kW.

Burco, Ltd., Burnley, Lancs.—**Stand X.10.**—A display of 5 and 10 gal wash boilers, washing machines, and drying machines, includes the following new products:—"Three-Ten" electric

Burco "Three-Ten" wash boiler

wash boiler with hand wringer and electric emptying pump; model 305 AS wash boiler with electric emptying pump; and the D2E "Tumblair" controlled heat electric drying machine (export model).

Burgess Products Co., Ltd., Micro Switch Division, Team Valley, Gateshead, 11.—**Stand M.15.**—Micro switches in great variety are displayed, including several new models.

W. Canning & Co., Ltd., Great Hampton Street, Birmingham, 18.—**Stand W.2.**—Electroplating and polishing equipment.

Carr Fastener Co., Ltd., Stapleford, Nottingham.—**Stand X.20.**—Snap-in neon indicator lights; domestic oven and refrigerator illumination fittings with door operated switches; plugs and sockets; quick connector devices; terminal strips; and a variety of spring fixing devices for domestic appliances. New products include a thermal cut-out and a midget switch.

Cayson Electrics, Ltd., 139, Queens Road, Watford, Herts.—**Stand D.3.**—The "Caytel" constant-voltage rectifier, a new development, is demonstrated, and there is a range of rectifiers, transformers, and fluorescent control gear.

Central Electricity Generating Board, Winsley Street, London, W.1.—**Stand B.3.**—Under the heading "Electricity Supply—The Industry behind Industry" factual information is given on the increasing demand for electricity and the growing productivity and prosperity which follow. There are also references to the nuclear construction programme and in particular the importance and difficulties of finding sites suitable for power stations. As in previous years, tickets for daily group visits to Battersea and Fulham power stations and publications and general information about the functions of the Board are available.

Chilton Electric Products, Ltd., Hungerford, Berkshire.—**Stand J.16.**—The new "Protector" miniature circuit-breaker is prominently featured in a display of single-pole units with ratings from 5 to 60 A and is also shown in distribution boxes of various sizes up to 36-way, s.p. and n. A new range of earth-path monitoring units and a remotely-controlled solenoid operated circuit-breaker are of special interest and another introduction is the style "C" rotary switch rated from 16 to 200 A at 600 V a.c. A range of universal shaver sockets is also displayed and domestic exhibits include spin dryers, dry shavers, and the "Acculux" rechargeable torch.

Chloride Batteries, Ltd., Clifton Junction, Manchester.—**Stand K.21.**—"Keepalite" standby emergency lighting equipment is displayed. Batteries include "Exide" and "Drydex" types.

C. M. Churchouse, Ltd., Clarendon Cross, London, W.11.—**Stand Y.8.**—Decorative, commercial and industrial lighting fittings.

CIBA (A.R.L.), Ltd., Duxford, Cambridge.—**Stand T.8.**—Examples of the many uses of "Araldite" epoxy resins in the electrical industry can be seen. The exhibits include casting resins for manufacturing h.v. insulators and bushings; resins for impregnating and potting transformers of all sizes; resins for glass-cloth laminates; protective coatings; and adhesives.

Clang, Ltd., Cricklewood, London, N.W.2.—**Stand F.5.**—A range of domestic accessories including switches, lampholders, ceiling roses, junction boxes, etc., and also conduit

Clang weatherproof socket

accessories, is displayed. Among weatherproof accessories is a robust type of plug and socket.

Clare Instrument Co., Ashacre Lane, Worthing.—**Stand H.1.**—Electrical test gear includes flash testers, limit bridges, megohmmeters, earth circuit testers, etc. Portable multi-range test sets are among the new products shown.

H. Clarke & Co. (Manchester), Ltd., Atlas Works, George Street, Patricroft, near Manchester. — **Stand M.14.** — Various types of laminated materials; Micanite vee rings, tubes and panels; and plastic cable trunking.

E. K. Cole, Ltd., Southend-on-Sea, Essex.—**Stand B.2.**—The new Ekco "Thermovent" WM series of electric convectors replace the previous MRL heaters which have been widely used for many years. The WM models are completely re-styled, have a smaller projection from the wall and are easier to install. The established range of "Thermovent" convectors includes the portable FR series, with plastic front panels in a choice of colours; the K series of floor-standing metal-cased models; and the B series of plastic-fronted inset heaters. Radiant fires and the "Firestreak" wall-mounting infra-red fire are also shown as well as the "Radiant Glass" "Thermo-panel," a heater in which the element is fused directly on to a toughened glass panel. For industrial use the company displays the "Thermostor" thermal storage heater, high temperature panels for suspension by chains from the ceiling or wall, the "Twin-streak" overhead radiant heater, and unit fan heaters. Other Ekco heating appliances include standard, flame-proof and horticultural "Thermo-tubes," a soil heater, piano heater, pipe heater, window demisting unit and a range of thermostats. There are also electric blankets.

Combination Metallic Packing Co. (1921), Ltd., Glasshouse Street, Newcastle-on-Tyne, 6. — **Stand Y.1.** — Exhibited for the first time is a range of cable glands covering every aspect of cable termination.

Contactum, Ltd., Edgware Road, Cricklewood, London, N.W.2.—**Stand J.21.**—Additions to the company's range of flush a.c. switch units are "See-saw" switches—1-, 2- or 3-gang switches on a 3¼in square plate, with rocker dollies (instead of the conventional pegs). Other new products include a 15 A surface switch and a 15 A pull cord switch, both available in either single or double pole.

Controlled Heating Units (London), Ltd., Avenue Road, Hampton, Middlesex.—**Stand Q.8.**—Examples from a wide range of metal sheathed, mineral embedded elements for domestic and industrial purposes, available in straight lengths, preformed to requirements, or as complete units. The domestic field is covered by a range of immersion heaters, elements for kettles, washing machines, oil-filled radiators, etc. In the industrial section there are elements for refrigeration defrosting, sterilisers and oil pre-heaters.

Copper Development Association, 55, South Audley Street, London, W.1. **Stand L.11.**—As on previous occasions the presence of this impressive copper-clad stand will help to make better known the services of the Association that are available free to users or intending users of copper or its alloys. Many C.D.A. technical publications are on display.

Courtney, Pope (Electrical), Ltd., Amhurst Park Works, London, N.15.—**Stand L.8.**—Fluorescent and tungsten lighting fittings for commercial interiors, window and display lighting; luminous and flexible grid ceilings; and neon signs and cold cathode lighting.

J. A. Crabtree & Co., Ltd., Lincoln Works, Walsall, Staffs.—**Stand H.20.**—Switches and other wiring accessories include "Closegang" assemblies for surface and flush installations, a range of moulded pattresses for switches and ceiling roses having a diameter of 2 or 2½in, and 3-pin (round and flat pin) socket-outlets. Earth-leakage and miniature circuit-breakers for domestic and industrial use are featured, including a new 4-pole circuit-breaker. Type A-15 (oil-break) and type B-15 (air-break) starters and associated remote control equipment are displayed while the type D-6 (hand-operated) f.h.p. starters shown include three new patterns. The company has also introduced a new type J-60 (air-break) starter. When used on 415 V 3-phase supplies these are suitable for a line current of up to 60 A; up to 600 V the maximum line current is 40 A. For non-inductive and heater loads the current values may be up to 100 A on a supply of 415 V and up to 70 A at 600 V.

Creators, Ltd., Sheerwater, Woking, Surrey.—**Stand Q.10.**—Plastic electrical accessories on display include cable markers; binding sleeves and sleeving in p.v.c. and "Neoprene"; terminal blocks; strapping and trunking; and special purpose mouldings and extrusions. There is also a range of hand tools for use in electrical wiring work, including wire strippers, three-prong tools for use with binding sleeves, and a transformer operated soldering gun.

Critchley Bros., Ltd., Brimscombe, Stroud, Gloucestershire.—**Stand R.13.**—Cable markers in the form of interlocking ferrules, thimble ferrules, sleeves and clip-on types; phase buttons; and the "Beta" system of cable fixing for switch cubicles and control panels are among this company's exhibits. A new 19 mm "Beta" strip should be of interest to contracting engineers for supporting heavy multicores and armoured cables.

Crompton Parkinson, Ltd., Crompton House, Aldwych, London, W.C.2. — **Stand H.14.** — A sleeve-bearing model of the Crompton Series 5 motor; panel-mounted miniature instruments; and a modular recessed lighting fitting are among new products. Instruments are represented by standard, low speed, short range and intrinsically safe tachometers, panel mounting miniature ammeters and voltmeters, portable instruments, individual movements and spring mounted jewels. The complete range of "S" and "T" series f.h.p. motors are shown, including a sectionalised model of the new oil burner flange series "T" motor which complies dimensionally with American NEMA standards. A large rotor and stator from an auto-synchronous motor, a 400 c/s alternator, and a sectionalised self-regulating alternator represent larger rotating plant. Lighting fittings include the recently introduced "Pacemaker" fluorescent range as well as a "Modulume" ceiling. A 500 kVA T.1 transformer core and coil is exhibited out of its tank in addition to voltage transformer coils, a range of current transformers, a complete voltage transformer and a current transformer testing set.

R. & A. G. Crossland, Ltd., Cartbridge Lane, Walsall, Staffs.—**Stand K.19.**—Lighting fittings and reflectors include examples of the company's fluorescent reflectors combined with a power trunking system. Electric fires and convectors are also displayed.

Croydon Precision Instrument Co., Hampton Road, West Croydon, Surrey. — **Stand Y.6.** — Electrical measuring instruments on display include several types of potentiometers,

Croydon Precision Instrument Co.'s type P.3 portable d.c. potentiometer

Wheatstone bridges, resistance boxes, vacuo junction a.c./d.c. convertors, ohmmeters, and instrument switches.

Dale Electric (Yorkshire), Ltd., Electricity Buildings, Filey, Yorkshire.—**Stand S.11.**—The latest additions to the company's "Panther" and "Rhino" ranges of diesel-electric generating plants, with outputs from 1·25 to 102 kVA, are exhibited. One of the more recent models is the "Rhino" AM/5/DRX, having an output of 5 kVA at 50 c/s, 6 kVA at 60 c/s. The unit incorporates a Ruston 1 YWA air-cooled engine. Small portable petrol engine powered plants, and mobile trailer mounted diesel sets of high capacity are also on view.

Davis Sheet Metal Engineering Co., Ltd., Eley's Estate, Angel Road, Edmonton, London, N.18.—**Stand G.4.**—Exhibits include "Quick-Fix" cable trunking; floor and skirting trunking; busbar and tap trunking; busbar chambers and risers; general purpose boxes; and the new ¾in "Quick Punch." Tap trunking with isolators and circuit-breakers, and with fused plug and socket outlets, is also displayed.

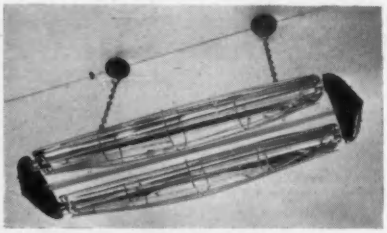
Delta Technical Services, Ltd., Cowleaze Road, Kingston-on-Thames.—**Stand H.22.**—Pressure switches, vacuum switches, thermostats, and flameproof instruments.

G. P. Dennis, Ltd., Fleming Road, Speke, Liverpool.—**Stand K.17.**—The company's latest design of medium voltage cubicle switchboard is shown, in addition to "Hi-Style" distribution fuse boards and on-load isolators. There is also a general display of examples of heavy duty metalclad switchboards, substation frames and feeder pillars. An associated company, Trunduct, Ltd., show their busbar supply systems and rising mains. A feature of these systems is the elimination of the normal tap-off box for branch circuit position.

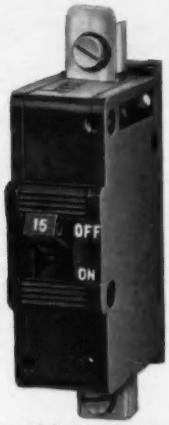
"Diamond H" Switches, Ltd., Gunnersbury Avenue, London, W.4.—**Stand J.2.**—On show for the first time are a series BR hermetically sealed miniature relay designed for guided missile and high-speed aircraft applications; the 80A/82A series neon indicator in which the neon bulb and lens project in front of the mounting panel to give maximum illumination and wide angle of observation; and the 12AC series heater switch introduced for washing machine and wash boiler applications where switch chamber temperatures do not exceed 180/200 deg F.

Dimplex, Ltd., Millbrook, Southampton.—**Stand J.8.**—Electric heaters for the home, commerce and industry are displayed. These include a full range of permanently oil-filled thermostatically controlled electric radiators, from ½ to 3 kW; skirting board styled convectors in two standard models (2ft 300 W and 3ft 500 W); and 750 W infra-red heaters, both switched and unswitched versions. Portable infra-red fires in 750 and 1,500 W sizes are also on view as well as oil-filled electric airing cupboard heaters (150/300 W); and towel rails (90 to 200 W). For commercial use the company has introduced infra-red heaters in 750 and 1,500 W loadings, while for industry there are overhead radiant heaters in 2½ and 4 kW sizes. The company also display Buxton certified oil-filled electric radiators.

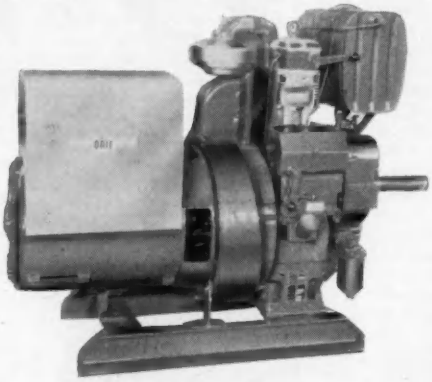
Donovan Electrical Co., Ltd., 70-82, Granville Street, Birmingham, 1.—**Stand E.3.**—Industrial contactor gear and allied equipment comprises motor starters; controllers; relays; contactors; push-buttons; limit switches and other control accessories; "Runtact" power



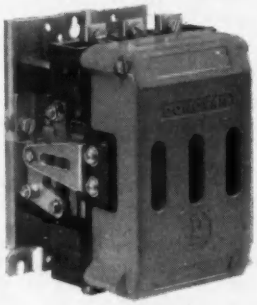
Dimplex commercial type 1½ kW infra-red heater, model IRC.1500



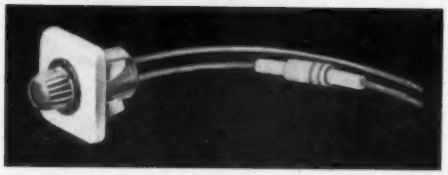
Dorman & Smith "Loadmaster" miniature circuit-breaker



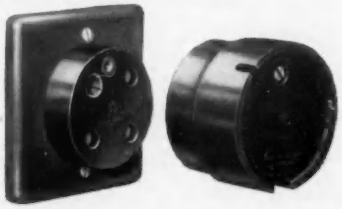
Model AM/5/DRX diesel-electric 5 kVA generating set from the Dale Electric "Rhino" range



Donovan 15 h.p. 400/440 V, 3-phase block type contactor



Above: "Diamond H" Switches series 80A/72A neon indicator (square face plate type)



Right: D.S. Plugs 15 A 500 V industrial socket and plug

Dubilier "Duconol" capacitor for outdoor use

duct system for feeding cranes, hoists and portable tools; industrial switch sockets and plugs; changeover switches and crane trolley wire safety switches. Of particular interest is a block type contactor (rated at 15 h.p. on 400/440 V, 3-phase) which can be fitted with up to twelve electrical interlocks, and can be positively mechanically interlocked either horizontally or vertically.

Dorman & Smith, Ltd., Atherton Works, Blackpool Road, Preston, Lancs.—**Stand H.15.**—Latest developments of the Dorman system of switchboard building include a new type of cubicle construction. Type "TS" switches up to 750 A rating together with cable accessories are also shown as well as "Loadmaster" miniature circuit-breakers, as separate units and in distribution boards. The m.c.b.s are now available in 5 to 60 A ratings, s.p., d.p. and t.p. Also of interest is the "Loadmaster" domestic unit which has received wide recognition by housing authorities.

D.P. Battery Co., Bakewell, Derbyshire.—**Stand H.5.**—Both standard and high performance "Tudor" stationary cells as used for switch operation and all forms of emergency duties are displayed, while the "Kathanode" cells shown are those used for electric traction purposes and for engine starting in diesel locomotives.

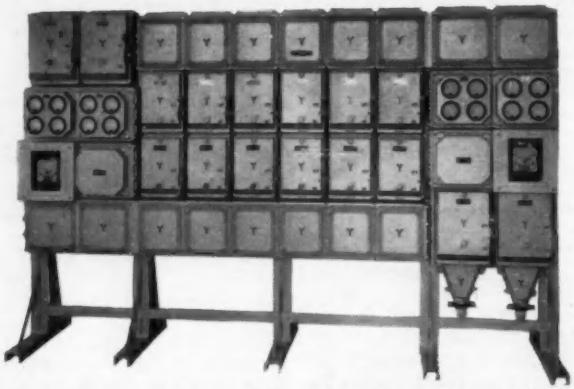
D.S. Plugs, Ltd., Atherton Works, Blackpool Road, Preston, Lancs.—**Stand H.15.**—Emphasis is placed on the comprehensive range of industrial plugs and sockets and fused couplers manufactured by this company. The sockets are fully shuttered and the fused pins in the plugs can be removed without dismantling the plug body and without the use of tools.

Dubilier Condenser Co. (1925), Ltd., Ducon Works, Victoria Road, North Acton, London, W.3.—**Stand L.13.**—Power-factor correction capacitors, including automatic control equipment; "Duconol" capacitors for fluorescent lighting and other a.c. applications, also water-cooled types; "Drilitic" capacitors for a.c. capacitor start motors; automatic voltage and speed regulators; servo regulators; electromagnetic mercury switch relays; and tubular slide-wire rheostats and resistances.

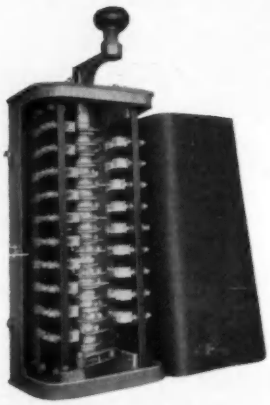
Dyson & Co., Enfield (1919), Ltd., Southbury Works, Ponders End, Enfield.—**Stand Y.9.**—Aluminium and zinc base alloy pressure die castings.

Easipower, Ltd., Shipyard Estate, Hythe, Southampton.—**Stand X.5.**—Electric blankets and domestic heating appliances.

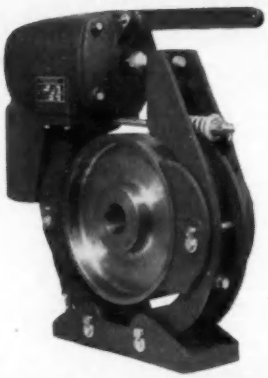
E.F. Electric, Ltd., Willow Lane, Watford, Herts.—**Stand B.6.**—New products include a range of 13 A plaster depth accessories (1- or 2-gang socket units, 1-gang switched socket units), all with insulated front plates or brass plates of various finishes. Surface units will also be available with stove enamelled steel plates. The company's 5 A mini-gang plaster depth switches are claimed to be the only grid mounted switches available where three units can be mounted in a standard plaster depth box.



An example of a unit construction duplicate busbar type "Y" switchboard (Electro Mechanical Manufacturing Co.)



E.M.B. Co.'s new cam-operated master controller



"K" type electro-mechanical brake for connection to d.c. supply, suitable for crane or winch duties (Elliston, Evans & Jackson)

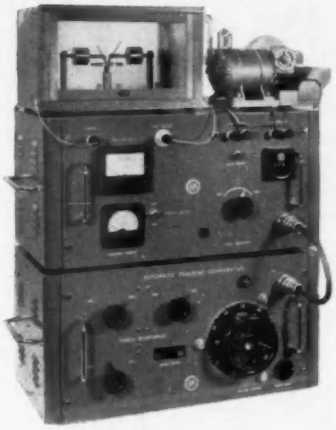
Ega Electric, Ltd., Holyhead Road, Wednesbury, Staffs.—**Stand K.18.**—P.v.c. non-metallic "Egatube" conduit and conduit fittings; metallic conduit fittings; and types PIR/A and PIR/B plug-in relays.

Ekco-Ensign Electric, Ltd., 45, Essex Street, Strand, London, W.C.2.—**Stand C.4.**—The recently introduced "Essex" range of fluorescent lighting fittings can be seen as well as the "Economy Range," which has been developed to meet the requirements of those who want fittings of quality at moderate cost. Fluorescent tubes are prominently displayed and particular emphasis is given to the new general purpose "Quickstart" tube. Tungsten lamps and their associated fittings, with lighting accessories and control gear, etc., complete the exhibit.

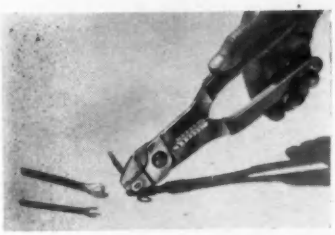
Electric Construction Co., Ltd., Bushbury Engineering Works, Wolverhampton.—**Stand E.8.**—Typical items from the company's range of rotating machines, switchgear, contactor type control gear, static transformers, rectifiers, with industrial electronic equipment for line drives, and other applications are being shown. Among switchgear exhibits is a 415/240 V 3-phase 4-wire alternator control switchboard, having two 247 kW alternator control panels, and a 600 A feeder panel connected to busbars. A 500 kVA, 11 kV/433 V transformer complete with h.v. and l.v. cable boxes is included in the transformer display.

Electric Transmission, Ltd., Newstead, Trentham, Stoke-on-Trent.—**Stand R.3.**—Transmission line fittings include h.v. h.r.c. fuses; expulsion fuses; fuse mounts; and "Silmex" light and heavy voltage air-break switches. Among new products the company is showing "Dimex" cementless transmission line insulators for voltages between 33 and 132 kV.

Electrical Apparatus Co., Ltd., St. Albans.—**Stand G.17.**—A.c. and d.c. manually operated and fully automatic motor control gear, indicating instruments and accessories, in industrial and flameproof enclosures are exhibited. The newly developed plug-in type motor control centre provides



Automatic tracking tester (Electrical Research Association)



Erma crimping tool for solderless wiring

centralised grouping of direct-on motor starters combined with maximum adaptability and convenience of maintenance.

Electrical Association for Women, 25, Foubert's Place, London, W.1.—**Stand O.10.**—"More Points for Plugs" is the theme of the E.A.W. stand, where socket outlets for the modern home, new and old ways of wiring, the ring circuit for home safety, and the five circuits in the well-wired home are illustrated.

Electrical Remote Control Co., Ltd., The Fairway, Bush Fair, Harlow, Essex.—**Stand M.8.**—Automatic electrical timing and control instruments include multi-circuit, multiple interval timers; continuous cycling and hand-set timing equipment; multiple contact and mercury relays; all for operation on a.c. and d.c. Miniature synchronous cam operated timers (type MSC), miniature automatic timers (type AMS) and a range of timing and control equipment in flameproof enclosures are exhibited for the first time.

Electrical Research Association Laboratory, Cleeve Road, Leatherhead, Surrey.—**Stand B.4.**—One of the two principal exhibits is the prototype of an automatic resistance tracking tester. The apparatus uses improved means for controlling the application of drops of electrolyte and, in addition, incorporates a more convenient form of electrode holder and provides for adjustment of the delay on the relay which determines the end-point of the test. These facilities will enable information to be obtained concerning details of the I.E.C. method with which the United Kingdom is not entirely satisfied. The other demonstration concerns insulation failures. In the course of its general work on breakdown problems the E.R.A. has designed an experiment in which the breakdown in a gap of some 3 mm is viewed through an optical system giving a magnification of about 100; the applied voltage is adjusted so that breakdown occurs in about 15 or 20 minutes. During this time the formation of the breakdown channels can be watched and, if the voltage is removed before these span the gap, the system of channels can be examined at leisure.

Electro Automat, Ltd., Swinton, Manchester. — **Stand S.17.** — High stability selenium rectifiers are displayed, including rectifiers specifically designed for direct mounting in printed circuits. The "Automat" rectifier kit is also to be seen as well as transformers and d.c. equipments.

Electro Dynamic Construction Co., Ltd., St. Mary Cray, Kent.—**Stand J.27.**—The exhibits on this stand consist of a varied selection from the company's range of rotating electrical machines. There are examples of marine type motors, alternators and vertical pump motors, high frequency machines with magnetic amplifier or electronic voltage regulators for radar, echo sounding or similar applications; machines up to 10,000 c/s, as used with industrial high-frequency induction furnaces; an example of an "Electro Dynamic" magnetic coupling; and rotary converters and transformers. In the control gear section are examples of panels for the control of a series of emergency standby generators; Admiralty pattern gantry-crane control panels; and marine type faceplate starters, etc.

Electro Mechanical Manufacturing Co., Ltd., 133-135, Grand Buildings, Trafalgar Square, London, W.C.2.—**Stand F.2.**—The company's exhibits include all-isolating cubicle switchgear incorporating fuse switch and motor control circuits constructed to form an attractive flush-fronted arrangement for rear or front access. In addition the latest design of industrial, unit construction, type "Y" switchgear is on view in the form of fully unitised switchboards for both indoor and outdoor conditions of normal or tropical service. Both classes of gear are suitable for grouped control centres incorporating switches, fuse switches, distribution panels, circuit-breakers and motor control circuits.

Electro Methods, Ltd., Caxton Way, Stevenage, Herts. — **Stand L.15.** — Miniature and sub-miniature plugs and sockets, connectors, relays, time delays, temperature controls, solenoids, tacho-generators, and industrial control equipment.

Elliott Brothers (London), Ltd., Century Works, Lewisham.—**Stand L.14.**—A reflecting dynamometer; rectangular switchboard and panel instruments; the "5000" a.c. test set; long scale switchboard instruments; miniature panel instruments; multi-channel recording instruments; and speed indication and recording equipment are shown by the Electrical Measuring Division. The Mechanical Engineering Division has on view a low frequency generator and a reluctance motor for raising and lowering a control rod in nuclear reactors; ball resolvers; and an a.c. gyroscope. The Industrial Weighing Division show a high-speed check weigher designed to check the weight of canned and packaged goods ranging from a few ounces to several pounds.

George Ellison, Ltd., Perry Barr, Birmingham, 22B.—**Stand L.10.**—A new air-insulated 11 kV, 250 MVA circuit-breaker unit, A.S.T.A. certified to B.S. 116 : 1952 and complying with B.E.B.S.-S2, is introduced. Suitable for service with this circuit-breaker unit there is a new 11 kV 250 MVA oil switch unit, A.S.T.A. tested to B.S. 2631 : 1955. The circuit-breaker unit, rated at 400 A, has air insulated busbars and current transformers and although only 24in wide all parts are easily accessible for maintenance. The oil switch has a normal current carrying capacity of 400 A; a breaking capacity of 400 A; and a making capacity of 250 MVA. It is manually operated by charging and releasing a spring with one movement of the handle, both "making" and "breaking" being independent of the operator. Blade type, high pressure line contacts give a single break per phase.

Elliston, Evans & Jackson, Ltd., Bridgwater, Somerset.—**Stand S.27.**—Electro-mechanical brakes shown include the company's new "K" and "U" types for d.c. solenoid operation. Both are fitted with pivoted, self-aligning brake shoes. Examples of a.c. and d.c. solenoids, with and without flameproof enclosures, can also be seen. Switch equipment for electric lifts includes a working floor selecting switch, with special features for ease of floor levelling adjustments, and a control panel and other switches.

E.M.B. Co., Ltd., Moor Street, West Bromwich, Staffs.—**Stand F.17.**—A size 00 "Microsen" a.c. speed control unit demonstrating the control of the hoisting and lowering motion on a crane may be seen on this stand. It is suitable for use with motors up to 2 h.p. and is controlled from a new design of E.M.B. crank handled, cam-operated, 7-notch controller. Double-break silver faced contacts are used, suitable for carrying up to 10 A at 660 V. The "Microsen" is made in four other sizes for controlling motors up to 140 h.p.

E.M.P. Electric, Ltd., Garman Road, Tottenham, London, N.17.—**Stand U.2.**—Improvements have been made both electrically and dimensionally in the range of lightning arrestors for application both on medium and e.h.v. transmission lines. H.v. expulsion fuse equipments with tester ratings at 11·15 and 33 kV are also shown, as well as a new range of semiconductor rectifier l.v. fuses with high-speed characteristics and special provision for low arc voltage performance. The company's certified range of m.v. h.r.c. fuse links has been extended by the introduction of new types which have been fully tested.

E.M.S. Electrical Products, Ltd., Common Lane, Kenilworth, Warwicks. —**Stand E.11.**—Power distribution systems include the "Trolleymaster," the "Uniduct" and the "Trolleyduct"; the "Minibus," a 4-conductor busbar system; the "Plugbus" distribution duct; and the "Miniplug" for lighting and single-phase power.

Enfield Cables, Ltd., Victoria House, Southampton Row, London, W.C.1.—**Stand J.11.**—Electric cables and accessories, and ancillary equipment.

Engel & Gibbs, Ltd., Warwick Road, Boreham Wood, Herts.—**Stand K.23.** —New products include process timers, micro switch relays, plug-in impulse relays, and a re-cycling unit.

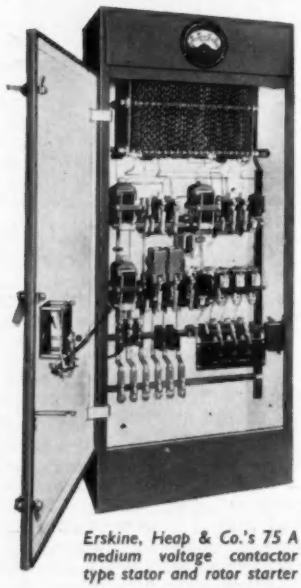
Engelhard Industries, Ltd. (Baker Platinum Division), 52, High Holborn, London, W.C.1.—**Stand P.6.**—From the range of standard electrical contacts manufactured by the company, available in a variety of materials, a selection of headed rivets, contact bimetal rivets, composite contacts and contacts for projection welding are displayed. Special type contacts, assemblies, inlay and overlay bimetal strip and fabricated bimetal parts are also on view, and of special interest is a display of thermocouple contacts used in the measurement of fuel element can temperatures in commercial nuclear installations.

Engineering & Building Equipment Co., Ltd., Market Road, Lower Richmond Road, Richmond, Surrey.—**Stand R.11.**—Tools, plant and equipment for the construction and maintenance of overhead lines include conductor running snatch blocks; conductor running rollers; tension and straining ratchets; come-along clamps; pole lifting pikes; a 2-ton power driven portable winch; wire rope fittings; welding transformers; cable drum jacks; hook ladders; post hole spoons; earth augers and rotolift pull jacks.

English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—**Stand M.11.**—In this display, which covers motors, transformers, fusegear, switchgear, rectifiers, relays, instruments, etc., various departments of the company are represented. A 3 h.p. magnetic amplifier motor control unit and a ½ h.p. "Magamp" motor control unit are shown by the Control and Electronics Department, while the Fusegear Division includes combination fuse switchboards; "Super-form" switchboards; and a range of heavy duty "Red-Spot" fuseboards. A special feature of the Fractional H.P. Motor Department is a new washing machine motor. The Instrument Department presents electrical measuring instruments, including miniature moving coil and moving iron type 90 deg switchboard instruments, and 240 and 360 deg instruments. A rural type transformer and component parts, a 300 kVA substation type transformer and a 200 kVA mobile mining transformer are shown by the Transformer Department. The Domestic Appliances Division features the model 2031 automatic cooker; washing machines; and the "Slim-Line" table-top refrigerator.

Erma, Ltd., Mount Pleasant, Alperton, Wembley.—**Stand S.15.**—The "Erma" crimping kit for solderless wiring consisting of a new crimping tool, which also cuts and strips wire, and an assortment of solderless terminals are shown for the first time.

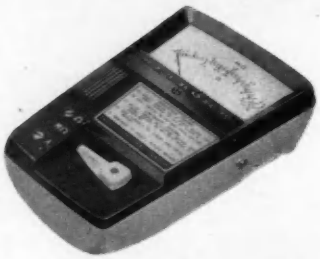
Erskine, Heap & Co., Ltd., Broughton, Manchester, 7.—**Stand A.9.**—Examples of the company's range of switchgear and motor control gear



Erskine, Heap & Co.'s 75 A medium voltage contactor type stator and rotor starter

include vertical isolation units, medium voltage up to 31 MVA, 3·3 kV up to 75 MVA and 6·6/11 kV up to 250 MVA. In addition there are many examples of motor control gear, particular emphasis being made on the contactor type starters which are so arranged that they can be readily embodied in multi-motor control panels. Flameproof equipment is also exhibited and of particular interest are the patented contact arrangements on the medium voltage and 3·3 kV breakers, and the "Direct-Blast" arc control devices on the 250 MVA high voltage circuit-breaker.

Everett Edgcumbe & Co., Ltd., Colindale Works, Colindeep Lane, Hendon, London, N.W.9.—**Stand D.6.** —The main display is the company's new "Metrohm" insulation and continuity tester. This combines two instruments in one and gives positive steady readings on both the megohm insulation resistance range and the ohms continuity range. It consists of a transistor operated voltage convertor which derives its supply from a small battery. Being press-button operated, the instrument can be held in one hand, leaving the other free for manipulation of the test leads. For the transmission of instrument readings there is the model 3 auto repeater equipment, a transistor operated telemeter system. In addition, there are typical examples of indicating instruments from the company's "Synclock"



Everett Edgcumbe & Co.'s "Metrohm" insulation and continuity tester

self-starting miniature motors and graphic recording instruments. The graphic recording instrument shows the new capsule inking device and, in addition to this, a portable multi-range inkwell graphic minor recorder for use on a.c. supplies is displayed.

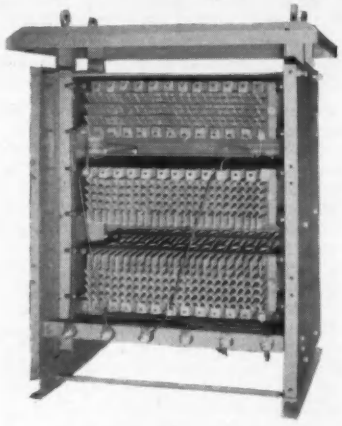
Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick, London, W.4. —**Stand C.1.**—Besides their standard range of products ten new instruments are exhibited by the company. These include a "Megger" line-earth loop tester designed to carry out the tests prescribed in I.E.E. Reg. 507; a "Megger" Series 1 dielectric test set developed for the Post Office; a 6-voltage "Megger" insulation tester, Series 1, particularly suitable for step voltage resistance tests; a Series 1 "Megger" earth tester, universal pattern, independent of temporary earth spike resistances; the "59" "Ducter" low resistance testing set (mains and battery versions); a miniature operation recorder of small size particularly suitable for use with multiple installations; a circular chart recorder for industrial and power generating measurements; pipeline "Dionic" conductivity equipment; and yarn tensioners for the textile industry.

Expanded Metal Co., Ltd., Burwood House, Caxton Street, London, S.W.1. —**Stand R.12.**—A range of industrial resistors, heaters and control equipment is exhibited by this company and its subsidiary, the Cressall Manufacturing Co. Products include asbestos

nets and grids; shunt field rheostats; heater units; and sliding rheostats. Among fixed and pre-set resistors are types wound on porcelain, steel tube and mica formers in addition to a new range of vitreous enamelled wire-wound and edge-wound resistors. New products include the "Edgemet" resistor; the "Torovolt," an improved variable transformer; and a newly designed a.c. voltage stabiliser.

Falk, Stadelmann & Co., Ltd., 91, Farringdon Road, E.C.1.—**Stand H.13.**—A new range of decorative tungsten commercial lighting fittings; a new coffee percolator; and a wide range of electrical wiring accessories are among the products on view.

Fawcett Preston & Co., Ltd., Bromborough, Cheshire.—**Stand X.2.**—Resistor exhibits include a 50 h.p.,



Fawcett Preston resistor for crane duty

500 V d.c. crane hoist motion resistor graded for series hoisting, potentiometer lowering and dynamic braking; a 75/80 h.p. dynamic braking resistor for use with a crane hoist motion (225/250 V d.c.); a neutral point earthing resistor, 13·8 kV, 200 A, 30 sec rating; a lightweight portable welding resistor, 40 V drop, with six parallel sections to give a total load of 305 A; a main starting resistor for battery operated flameproof mining locomotives; a rectifier tapping resistor for 25 kV electrification; and a wire wound battery charging resistor.

Fenton, Byrn & Co., Ltd., Airflow Works, Berrylands Road, Surbiton, Surrey.—**Stand K.1.**—The products exhibited include ring, wall, window, ceiling and desk fans; roof cowls; fan convectors; cabinet heaters; electric unit heaters; kitchen canopies and the ancillaries required for fan applications. New products are 30 and 36in propeller fans, and wall mounted fan convectors in two output sizes, 20/25,000 and 30/35,000 B.Th.U.

Ferguson Pailin, Ltd., Higher Openshaw, Manchester, 11.—**Stand L.6.**—A representative selection of switchgear accessories including rotary switches, instrument switches, fuses and links, etc., are shown. Of special interest is a new 6·6/11 kV 250 MVA, air insulated indoor metalclad unit with integral earthing facilities.

Ferranti, Ltd., Hollinwood, Lancs.—**Stand M.10.**—Transformer Department: One of the principal exhibits is the type DC3 on-load tap changer, a 3-phase high-speed resistor transition unit for 33 kV transformers which can be used in either star or delta operation at a maximum full load line current of 300 A on normal tapping and with a maximum of 16 steps. A 1 kVA moving coil voltage regulator; an 80 kV d.c. testing equipment; and a distribution transformer tank are also shown.

Meter Department: A wide range of house service meters includes single-phase, prepayment, and polyphase types and the recently developed remote reading meter and billing meter.

Electronics Department: A selection of klystrons which are used in all types of radar equipment is shown for the first time. There is also a display of ceramic-to-metal seals and silicon devices including the TR500 transformer/rectifier unit and the TR5 high-speed paper tape reader.

Instrument Department: Demonstration units and a selection of indicating and industrial instruments include a phase-earth loop impedance tester; a pole type clip-on ammeter; and four other models covering ranges from 0-10 to 0-1,000 A.

Computer Department: "Perseus" and "Pegasus" electronic digital computers are depicted by coloured transparencies.

Domestic Appliance Department: A panel fire (P.33132) and the "Fridge-Heater" are among items of special interest.

Foundry Department: Castings for the electrical, automobile, refrigeration and small tool industries are shown.

Fibreglass, Ltd., Ravenhead, St. Helens, Lancs.—**Stand S.8.**—A new product is fibreglass-base armature tape which eliminates the need for under-band insulation, eliminates eddy current losses in the banding and cut through to underlying coils and withstands temperatures that would cause failure in soldered steel wire. Class "C" fibreglass/silicone insulation for dry type transformers is also featured in a comprehensive display.

H. W. Field & Son, Ltd., Harold Wood, Essex.—**Stand Q.7.**—Fluorescent lighting fittings; tungsten lamp fittings (extended to include contemporary designs and more display lighting units); a fibreglass street lighting lantern; and, a new departure in plastics applied to lighting, a rigid unbreakable moulded lampshade in opal and four contemporary colours, known as "Fildenex No. 5."

Left: H. W. Field & Son's "Fildenex No. 5" plastic moulded lampshade

J. P. Filhol, Ltd., Millers Road, Warwick.—**Stand P.2.**—Dual bearings for instruments, meters and watches.

Fitzgibbon & Murray, Ltd., Smallfield Works, Horley, Surrey.—**Stand E.1.**—Exhibits include the company's range of "Ewell" and "Jeani" accessories, such as switch holders; bell pushes for table, wall and box mountings; flex connectors; torpedo switches; and candle tubes.

Formica, Ltd., 84-86, Regent Street, London, W.1—**Stand W.8.**—Many new grades of paper, fabric, and glass based laminates are shown, the last-named being of particular interest as a new copper-clad development is featured.

Fractional H.P. Motors, Ltd., Rookery Way, Hendon, London, N.W.9.—**Stand L.5.**—Universal, split phase, capacitor, 3-phase, synchronous and shaded pole motors from $\frac{1}{250}$ to $\frac{1}{4}$ h.p. and geared units of 0·125 to 600 r.p.m. and torque up to 850 lb/in. The latest models are lightweight, quiet running split phase types, one $\frac{1}{50}$ h.p. and the other $\frac{1}{15}$ h.p. (each 1,400 r.p.m., 50 c/s), with resilient base mounting, separate external current operated relay, and sleeve bearings.

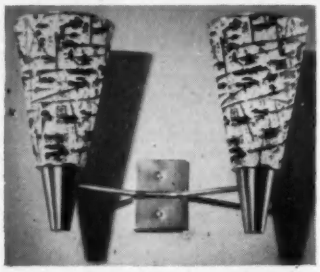
Fraser, Speller Transformers, Ltd., 96a, Sydenham Road, Sydenham, London, S.E.26.—**Stand Q.1.**—A.I.D. and A.R.B. approved transformers for all purposes. These include transformers for electronic equipment; subminiature types for transistorised circuits; aircraft transformers; portable l.v. transformers; and l.v. lighting units, etc. Transductors; saturable reactors; a 3 kV portable insulation tester; an inductance bridge; and a polarity tester, are also displayed.

Right: 10 kVA, single-phase 200-230/1,000 V oil immersed transformer (Fraser, Speller Transformers, Ltd.)

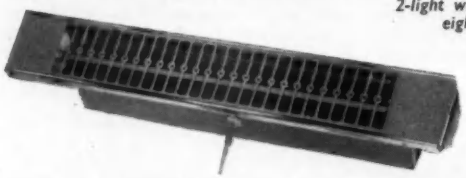
V. & E. Friedland, Ltd., Macclesfield, Cheshire.—**Stand J.3.**—A complete range of bell and chime equipment includes long and short tube type chimes; chime kits and bell kits; pushes, including illuminated models; and industrial bells.

Fuller Electric, Ltd., Fulbourne Road, London, E.17.—**Stand J.18.**—This company exhibits a new 33 kV 200 A high speed resistor on-load tap changer with integral direct drive mechanism for transformers up to 10 MVA; series capacitors; surge diverters; flow indicators; and an extensive range of ASEA relays.

Gatehill Manufacturing Co., Ltd., Kennard Road, Stratford, London, E.15.—**Stand Y.3.**—Among new products there are industrial and domestic versions of the "Becosil" range of infra-red heaters; safety illuminated Christmas trees; and electric boiling rings.



Above: A 2-light wall bracket from the G.E.C. "Friendly" range of lighting fittings comprising a 3-light pendant and 1- and 2-light wall brackets with a choice of eight different shade patterns



Left: Gatehill "Becosil" infra-red heater

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—**Stands J.15 and V.1.**—On the ground-floor stand attention is drawn to the latest advances in "Osram" lamps, lighting techniques and equipment for industry, commerce, street lighting and homes and for a wide variety of special lighting applications. An important feature is a demonstration of the newest technique developed by the company for producing high levels of illumination without glare; new 5ft fluorescent fittings for recessed, semi-recessed and pendant use and three new circular tungsten reflectors for industrial use are shown. A representative selection of contemporary design lighting fittings shown for the first time includes a range consisting of a series of precision-made parts from which can be built up a large number of types, from 3-light pendants for domestic use to 12-light or multi-tier units suitable for restaurants. For shop lighting there are new reflector lamp surface fittings, decorative reflectors, recessed fittings, surface lighting fittings, pendant units and accessories for the range of "Gecoray" fittings. There is also a new range of bi-pin type fluorescent fittings using retractable holders, an extension of the "Osram" "One-Eighty" fittings. "Osram" lamps and tubes include quartz tubular infra-red heaters, while in the display of street lighting lamps there is a new 280 W integral sodium lamp designed to give higher illumination levels for main road lighting. The company is also showing its new "Three-Eighty" lantern for 5ft 80 W tubes; this has a die-cast aluminium body and all auxiliaries, together with the wiring harness and tubeholders, are carried within the lantern on a quickly detachable die-cast aluminium tray. The Z8430CM lantern with an optical system designed for use exclusively with 250 or 400 W mercury (MBF/U) lamps is also shown as well as the Z9464, a side-entry mounting model. Among airport lighting fittings there is a neon obstruction light for use on situations such as power station chimneys or cooling towers.

Domestic equipment includes the new "Superb" cooker, claimed to be the first to combine the advantages of a drop-down oven door with a full-view inner glass door to the oven, and the new 4·1 cu ft table-top refrigerator, the "Fabulous Four." These two items together form a composite kitchen matching unit. The main exhibits on the gallery stand are of installation equipment and accessories for industrial, commercial and domestic purposes. There are a number of new designs, including an unusually small cubicle switchboard, each cubicle of which can be subdivided into a number of separate compartments by horizontal trays suitable for requirements ranging from 2 to 8 circuit assemblies. The main horizontal busbars at the top of the cubicle are rated at 1,200 A. Coupled to these are the vertical busbars rated at 600 A, and the assembly will withstand a short circuit equivalent to 25 MVA at 440 V. A new range of hose-proof, and weather-proof fuseboards suitable for all general, commercial and industrial purposes is also shown. Rated at 20 A, rewirable fuses are suitable for 440 V and h.r.c. fuses for up to 550 V working. An new range of reversing d.t.l. starters includes the series XBR (maximum rating 7½ h.p. at 600 V, 3-phase) and XCR (15 h.p. at 600 V, 3-phase). An air-pressurised electrical system which makes possible the installation of lighting and other equipment in an atmosphere containing a hydrogen hazard is demonstrated. Among the fire alarm equipment on show is a new range of ironclad bells and also an illustration of rising main busbar trunking, with a display of individual units attached. Cable trunking for all purposes includes skirting and floor trunking (both recessed and solid plate) and fused tapped trunking, while totally enclosed busbar power distribution systems on show cover ratings of from 75 to 300 A.

Gent & Co., Ltd., Faraday Works, Leicester. — **Stand L.12.** — Electric clocks, time recorders, programme instruments, and a range of sound signals including industrial and domestic bells and buzzers. Fire alarm systems are also featured as well as luminous call systems.

W. T. Glover & Co., Ltd., Trafford Park, Manchester, 17.—**Stand H.9.**—Cables for all electrical purposes include pre-impregnated p.i., v.r. insulated, and plastic types.

Greenwood Airvac Conduits, Ltd., 8, Southampton Row, London, W.C.1.—**Stand U.8.**—Underfloor, skirting and floor surface duct systems to suit office buildings, hotels, factories, schools, laboratories, etc., are shown. A demonstration layout of the "Airvac" underfloor duct system, suitable for 1¼in screed, shows the most recent developments. A new underfloor duct system, giving a greater flexibility and suitable for screed depths of ⅞in upwards, is shown for the first time. Floor outlets may be predetermined but the system also provides for having additional outlets at a future date.

Gulf Oil (Great Britain), Ltd., 6, Grosvenor Place, London, S.W.1.—**Stand G.8.**—"Gulfsil" transformer and switch oil; special insulating oils; inhibited oils; straight and inhibited turbine oils; heavy insulating oils; meter and instrument lubricants; electrical contact lubricants; insulating compounds; electrical rotating machinery greases; and time lag dashpot oils.

G.W.B. Furnaces, Ltd., Dibdale Works, Dudley, Worcs.—**Stand F.18.**—The Control Gear Division displays a selection of star delta motor starter panels of 10, 300 and 470 h.p., and also stator rotor starters of 7 and 50 h.p. for sewage pump work. A further multi-motor panel is shown housing d.o.l. starters, tropicalised for export to India. Open frameworks on which are mounted a selection of contactors and isolators up to 1,400 A enables visitors to examine in detail these items, while other equipment such as flush-mounting and boxed type push-buttons are available for inspection.

Hackbridge & Hewittic Electric Co., Ltd., Walton-on-Thames, Surrey.—**Stand N.10.**—Exhibits include a high-power mercury-arc rectifier unit employing cooled-cathode type bulbs; a large h.v. mercury-arc rectifier bulb having a capacity of 1,200 kW con-

tinuously; germanium rectifiers; high-frequency induction furnace equipment; transductor controlled selenium rectifier for welding; automatic voltage regulator controlling an adjacent rectifier bulb; and a range of h.v. outdoor overhead line switchgear in ratings up to 33 kV, 1,200 A, including equipment incorporating interrupter devices.

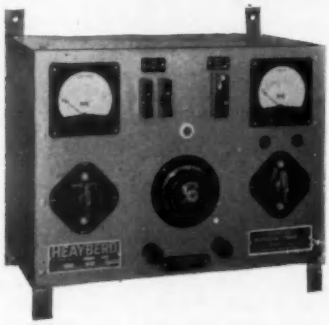
Harris & Sheldon (Electrical), Ltd., Ryder Street, Birmingham, 4.—**Stand H.16.**—"Handslite" fluorescent and tungsten lighting fittings; "Paragrid-Tile" illuminated ceiling system; and the "Luveline" decorative lighting pendant system.

Hawke Cable Glands, Ltd., Ashworth Street, Denton, Lancs.—**Stand S.13.**—Products displayed include joint boxes, through boxes and sealing ends for busbar termination, a flameproof junction box (circular type), plastic gland covers, and cable glands. In addition to glands for single-wire armoured cables, a "Hawke" gland for all types of double-wire armoured cables is shown.

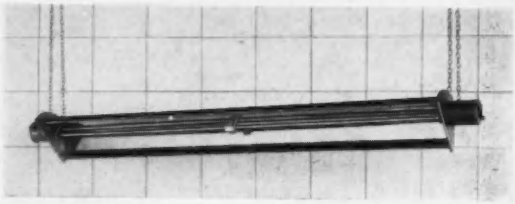
Heatovent Electric, Ltd., Lomond Street, Glasgow, N.2.—**Stand K.20.**—"Tuvec" electric heating equipment for domestic and industrial requirements includes convector heaters, panel heaters, air warmers, fan heaters, as well as flameproof and radiant units.

Heatrae, Ltd., Norwich.—**Stand M.5.**—Thermal storage water heaters and immersion heaters are prominently displayed. The "Lido" water heater is shown in three capacities, 1½, 2·2 and 3 gal. The "Saferod" high level domestic safety heater and the "Multirod" industrial heater are also on view, together with a range of radiant electric fires.

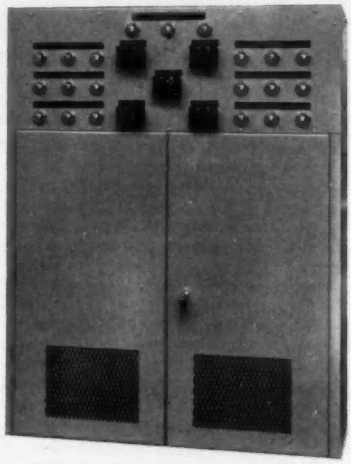
F. C. Heayberd & Co., Ltd., Greenwich South Street, London, S.E.10.—**Stand S.16.**—Transformers, rectifying equipment and battery chargers suitable for industrial applications are shown. All the rectifier units and battery chargers employ metal rectification and most of the equipment is available in models rated and finished for operation in temperate and in dry and humid tropical climates. A.c. and d.c. supply units suitable for schools and laboratories include one model



Heayberd 25 V 12 A a.c./d.c. supply unit for use in schools and laboratories



Heatovent ceiling suspended reflector heater for use in schools, churches, etc.



A typical Hewittic germanium rectifier for l.v. supply in a gas plant

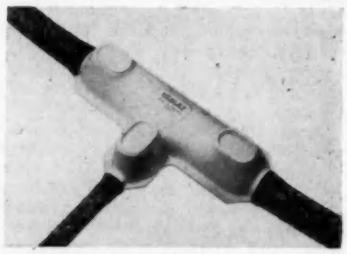
fitted with germanium rectification. An extended range of small transformers for power supplies in radio and electronic equipment is shown for the first time.

Hedin, Ltd., Commerce Estate, South Woodford, London, E.18.—**Stand E.10.**—New products include a vertical forced air circulation furnace (range 0-750 deg C); a shaker hearth furnace (range 0-1,000 deg C); a refrigeration unit; a forced air circulation laboratory oven (range 0-200 deg C), and an air duct heater. Among other exhibits are humidity cabinets and a range of industrial heating equipment.

Heenan & Froude, Ltd., Worcester.—**Stand S.7.**—An inexpensive type of f.h.p. packaged drive, the "Ajusto-Spede," introduced by the company comprises a fixed speed single- or three-phase induction motor mounted integrally with an eddy-current variable speed coupling in one housing. The motor and the coupling input member run at constant speed, whilst the speed of the output member is infinitely variable. A small tachometer generator is built into the housing and the variable speed shaft extends through the unit so that power is available at either end. The overall length of the unit is 15½in and the controller, which is similarly compact (5 × 5 × 6½in) may be mounted remotely from the drive. It consists of a single-valve electronic unit and as the amount of controlling current required is very small, low powered components can be used. The new Heenan - Dynamatic range of stationary-field eddy-current couplings include water and air cooled types for duties of up to 50 h.p. When used with standard control gear, infinitely variable speeds over a wide range are available, while many other control functions can be carried out by adapting the control gear to suit particular applications.

Hellermann, Ltd., Tinsley Lane, Crawley.—**Stand T.6.**—Of interest is the Hellermann binding system, which binds, insulates and identifies cable ends in one operation, by fitting plastic or rubber sleeves under tension with a three-pronged expanding tool. Compression terminals and tools; sealing devices and connectors; cable fixing accessories; and wiring tools are also on show. New products include a pneumatic sleeve-fitting tool; high temperature cable sleeves and markers; an inline coupler; plugs and sockets; and "Suprafix" spring-loaded terminal blocks.

W. T. Henley's Telegraph Works Co., Ltd., 51-53, Hatton Garden, London, E.C.1.—**Stand F.11.**—Wires and cables range from fine winding wires to cables up to 132 kV. Cables for transport are featured in displays of shipwiring cables, cables for railway electrification and aircraft cables, while mains cables include p.v.c. insulated, and f.i.n.d. (non-draining) types in



Henley plastic joint box for p.v.c. insulated mains cables

Heenan & Froude "Adjusto-Spede" f.h.p. packaged drive

addition to the normal paper insulated cables. A range of new plastic joint boxes for use with p.v.c. insulated mains cable is shown for the first time. These include straight-through, service and branch boxes, together with all accessories for making the joints. Other new items are samples of oval conductor, oil-filled 33 kV cable and special h.v. cables manufactured for export purposes.

Heyes & Co., Ltd., Wigan.—**Stand Y.11.**—Flameproof fluorescent fittings, certified for use in all groups and offering many advantages including simplified tube changing, are on show, also a range of surface and flush-type round bulkhead fittings and a flameproof/weatherproof fitting. Improved flameproof switches, switch-fuses, and busbar chambers are also featured. Lighting fittings with a large number of industrial applications are represented by a range of prismatic, "Lacent," "Duolacent" and wellglass units, including the "Wigan" wellglass pendant fittings and other flameproof types.

Higgs Motors, Ltd., Witton, Birmingham, 6.—**Stand D.12.**—A complete range of industrial motors to B.S. dimensions, both drip-proof and totally enclosed, is shown as well as f.h.p. motors and a range of geared motor units with outputs up to 30 h.p. and speeds down to 1 r.p.m. Variable speed 3-phase commutator motors with induction voltage regulator and push-button operated starter are connected to a 3-phase supply for demonstration purposes.

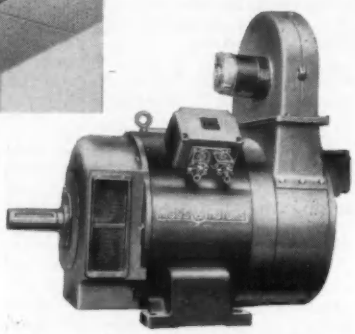
Hilmor, Ltd., Caxton Way, Stevenage, Herts.—**Stand L.16.**—Hand-operated hydraulic portable machines to bend up to 2in electrical conduit, and general purpose machines to bend all classes of ferrous and non-ferrous tubes.

Hirst Electronic, Ltd., Gatwick Road, Crawley, Sussex.—**Stand J.24.**—New equipment includes a 25 and 60 kVA heavy duty resistance spot welder; a welder specially designed for plastic coated sheet steel; constant potential d.c. rectifiers; and a peak current ammeter. The company is also showing single-pole a.c. and d.c. high-speed contactors; "BH" and "GV" spot and projection welders; hand welding tongs; air-conditioned welding and assembly benches; synchronous and non-synchronous welding control gear; transformers; rectifiers; saturable reactors and magnetising equipment.

Oswald Hollman, Ltd., 208, Kent House Road, Beckenham, Kent.—**Stand Y.13.**—Decorative and commercial lighting fittings include pendant and ceiling types, wall brackets, floor standards, table lamps and shades.

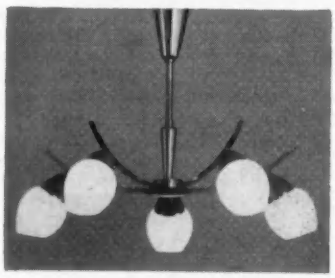
Holophane, Ltd., Elverton Street, London, S.W.1.—**Stand H.4.**—High bay lighting fittings suitable for lofty mounting heights in steelworks, hangars and power stations; covered and translucent fittings for application in low bays; and an extensive range of heavy duty bulkhead fittings with weatherproof, vapourproof features are displayed. The "In-Bilt" series of tungsten units, specially developed for commercial interiors, is also shown in addition to a range of "Lentilite" prismatic glassware. Samples of the special light controlling lens to be installed in the new "Shell" project on the South Bank are also available for inspection.

Holophane conical prism glass lens plate (No. 13-F-12X) of the type to be supplied for the fluorescent lighting installation for the new Shell building, South Bank



Higgs variable speed 3-phase commutator motor

Homeshade Co., Ltd., 99, Baker Street, London, W.1.—**Stand U.1.**—As manufacturers and importers of traditional and contemporary electric light fittings this company displays a wide selection of all types. The fitting illustrated, No. SL.2210, is a 5-light pendant fitting finished in polished brass with grey holders and centrepiece. The shades are of white opal glass.



Homeshade 5-light pendant fitting (No. SL.2210)

Honeywell Controls, Ltd., Ruislip Road East, Greenford, Middlesex.—**Stand W.3.**—Included in a display of micro switches and heating controls is a new sub-sub-miniature switch, type SX, which reproduces the performance characteristics of larger micro switches, while occupying only 0·035 cu in. The switch weighs $\frac{1}{28}$ oz, contact action is single pole, double throw, and it can be wired normally open or closed. Other new introductions are a plug-in limit switch, available with a wide variety of actuators; and the LS series of compact limit switches. The display also presents a range of existing switches, including basic types; toggle; industrial housed; high capacity; and hermetically sealed aircraft switches. Thermostatic controls on view include heavy-duty thermostats which can directly control heaters using up to 4,000 W; double throw thermostat for heating or cooling mechanisms; and systems of thermostats and combustion control relays for the complete control of oil-heating systems.

Hoover, Ltd., Perivale, Greenford, Middlesex.—**Stand V.2.**—The company has recently extended the range of the new Mark IV motor to include three-phase motors from $\frac{1}{6}$ to $\frac{1}{2}$ h.p., and motors for oil burners. The motors add considerably to the number of types available and do not supersede the square Mark II motor which continues to be made in large quantities. A range of totally enclosed motors is also available. The full range of Hoover f.h.p. motors now covers horsepowers from approximately $\frac{1}{10}$ to $\frac{3}{4}$ h.p. in a variety of types, and standard drip-proof and totally enclosed motors are available with a wide choice of mountings. All standard voltages and frequencies are covered, ranging from 100 up to 550 V, single- and three-phase, and from 25 to 100 c/s.

Among domestic products are the "Spinarinse" spin dryer, which pump-empties and rinses clothes without their being removed from the machine, and the recently introduced model 1334 "Junior" vacuum cleaner. This cleaner is supplied with a unique device for the instant attachment of the cleaning tools; it automatically uncouples the agitator driving belt from the motor pulley when the tools are to be used.

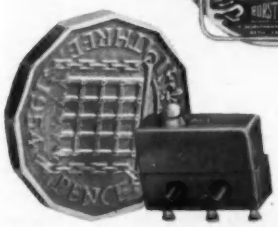
Horstmann Gear Co., Ltd., Newbridge Works, Bath.—**Stand Y.2.**—A display of electric time switches, cooker timers and flasher units includes two of the company's latest models, "K" Mark II and "Y" Mark II. The former is a synchronous motor driven switch and the latter an elec-

trically wound switch incorporating a 12 hour spring reserve. Both have a capacity of 20 A a.c. at 250 V. Another interesting switch is the type V/SRS which has a standard capacity of 20 A at 250 V but will handle a resistive heating load of 30 A at 250 V. It is a synchronous motor driven unit incorporating a 3-day spring reserve, and is used extensively for off-peak tariff control.

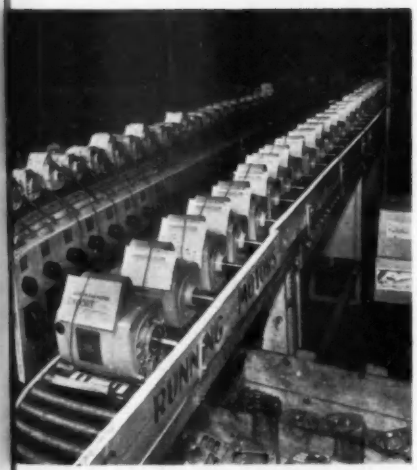
Hume Atkins & Co., Ltd., 66, Victoria Street, S.W.1.—**Stand R.6.**—Lighting fittings for schools, hospitals and offices include a new range of fluorescent fittings.

A. H. Hunt (Capacitors), Ltd., Bendon Valley, Wandsworth, S.W.18.—**Stand N.1.**—Included in the wide range of capacitors exhibited are "Therminol" p.f. improvement capacitors with non-inflammable impregnant and coolant and with reduced dimensions. Water-cooled high-frequency furnace capacitors are also shown.

Right : Horstmann type "Y" Mk. II time switch



Honeywell Controls sub-sub-miniature micro switch



Hoover f.h.p. motors undergoing running tests at the company's factory at Cambuslang, Lanarkshire

Alfred Imhof, Ltd., Cowley Mill Road, Uxbridge, Middlesex.—**Stand X.17.**—Standard cubicles for the electrical industry.

Imperial Chemical Industries, Ltd., Kynoch Works, Witton, Birmingham, 6.—**Stand W.6.**—The display of the Metals Division includes zirconium, niobium, vanadium; reactor fuel "Cans" and "Integron" high-fin steel integral finned tubing specially designed for nuclear heat exchangers. On the same stand the Nobel Division is showing silicone resins and rubbers, while the Plastics Division illustrates the development of plastic materials for the lighting and electrical industries.

Industrial Tapes, Ltd., 142-146, Old Street, London, E.C.1.—**Stand S.20.**—Pressure sensitive materials covering a wide range of industrial applications include polyester film; layout and production aids for printed-circuit work; polymerising (thermosetting) toughening elastomer saturated paper; and identification materials. The last-named include thermosetting self-adhesive labels, cable markers and diagrams made to customer's specification.

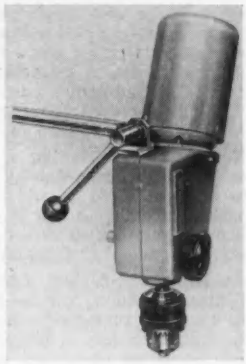
Insuloid Manufacturing Co., Ltd., Leestone Road, Wythenshawe, Manchester, 22.—**Stand Q.4.**—The "Cradleclip" wiring system consisting of binders and endless extensible clips for unsupported wiring, and cradles and endless extensible clips for anchored wiring, is shown. A new addition to the range of cable clips is the "NX" type which possesses twice the strength in only half the weight of the "X" type clip. They withstand temperature ranges from −80 deg C to +150 deg C and in addition to being shockproof, weatherproof and non-inflammable, are resistant to a large range of acid and chemical attack.

Ioco, Ltd., Netherton Works, Anniesland, Glasgow, W.3.—**Stand Y.12.**—Laminated plastics and electrical insulating cloths and tapes.

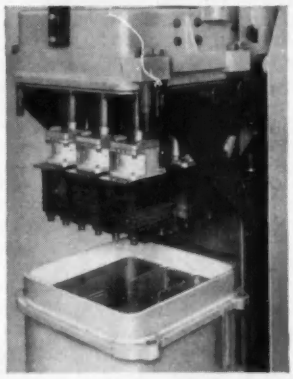
Jeary Electrical Co., Ltd., 132-142, East Road, N.1.—**Stand J.9.**—Industrial electrical equipment comprising geared motor units, f.h.p. motors, exhaust fans, time switches and all types of switchgear.

Richard Johnson & Nephew, Ltd., Forge Lane, Manchester, 11.—**Stand H.11.**—Copper wire, strip and strand for the electrical industry.

Johnson & Phillips, Ltd., Charlton, London, S.E.7.—**Stand C.7.**—Selections from the company's current production of h.v. and l.v. switchgear, transformers and capacitors, together with a wide range of power, control and wiring cables are displayed. A special switchgear exhibit is the new 150 MVA 3·3 kV arc-control oil circuit-breaker for the control of power station auxiliaries, colliery pit-head installations, etc. It is of double-break design, incorporates cross-jet arc-control devices of an improved pattern and is available with cast epoxy resin bushings. Other exhibits include the type NX unit, a non-extensible metal-clad ring-main unit for systems up to 11 kV and up to 250 MVA, and types of AG and FG 16 metalclad gear. In the transformer section a core and winding for a 1,500 kVA transformer is shown together with a 90 kVA welding transformer with its associated welding regulators. Capacitor exhibits include a bank of 3-70 kVAr capacitor panels with contactor panel, top busbar trunking and 3-core cable box; a 40 kVAr unit with contactor; and a 25 kVAr capacitor fitted with a switch-fuse unit.



Jones & Stevens model RZR laboratory stirrer



The new Johnson & Phillips 150 MVA 3·3 kV arc-control oil circuit-breaker showing the arc-control devices and the 3-phase barriers within the oil tank

Walter Jones & Co. (Engineers), Ltd., 36, Newlands Park, Sydenham, London, S.E.26.—**Stand X.19.**—A.c. servo motors and "Perminduct" synchronous motors are among new products. Other exhibits include frequency changers; rotary transformers; geared motors and gear units; convertors and invertors; tachometer generators; and special research and laboratory equipment.

Jones & Stevens, Ltd., Long Lane, Littlemore, Oxford.—**Stand S.14.**—Miniature a.c. shaded-pole motors (10 to 50 W input); capacitor motors and miniature reduction gears; variable speed transmission (2,000 to 100 r.p.m.); an improved model RZR

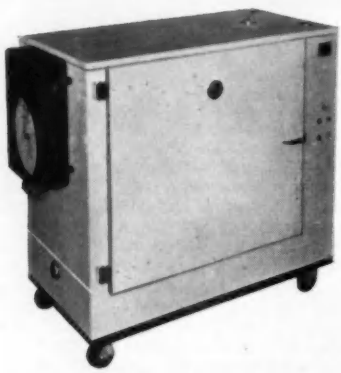
laboratory stirrer with double shafts, adjustable chuck, and full motor performance over its entire speed range; the "Minex" domestic extractor fan; and the new "Super Minex" extractor fan fitted with a reversible motor and transparent built-in air excluder (17,000 cu ft/hr air extraction).

Kent Bros. Electric Wire Co. & E. H. Phillips, Ltd., Kew Works, Bracknell, Berkshire.—**Stand H.3.**—A complete range of insulated copper winding wires and strips is displayed.

James Kilpatrick & Son, Ltd., 21, Tothill Street, London, S.W.1.—**Stand J.6.**—As electrical engineering contractors this company has technical and material resources covering power stations, overhead and underground transmission, outdoor and indoor substations, industrial installations, etc., and engineers are available to advise on technical and design problems.

Klockner Moeller (England), Ltd., Goswell Road, London, E.C.1.—**Stand W.7.**—Wall and floor mounted control cubicles, in plastic and sheet metal, are shown. These moulded unit switchboards have busbar ratings of up to 600 A and their transparent fronts enable faults to be located immediately.

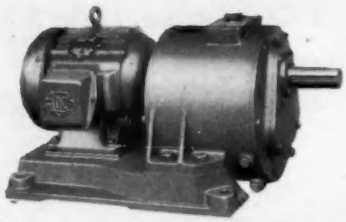
Laboratory Equipment (London), Ltd., 18-20, Dames Road, London, E.7.—**Stand S.28.**—"Weyco" laboratory equipment includes an automatic climatic cabinet; an air flow laboratory



"Weyco" climatic cabinet (Laboratory Equipment (London), Ltd.)

oven; a heavy duty stirrer; the "Fac" industrial construction system; humidifiers and de-humidifiers; and a corrosion tester. The company is also developing a range of portable humidity chambers and units capable of converting rooms into humidity controlled rooms.

Lancashire Dynamo Electronic Products, Ltd., Rugeley, Staffs.—**Stand T.1.**—Representative examples of electronic industrial equipment are shown, particular emphasis being placed on a comprehensive range of adjustable speed drives. In addition to several new developments, the display includes examples from the "Transidyne" series of fully transistorised packaged Ward-Leonard drive installations.



L.D.C. coaxial type triple-reduction geared motor unit (Lancashire Dynamo & Crypto, Ltd.)

Lancashire Dynamo Group, Trafford Park, Manchester, 17.—**Stand E.6.**—The exhibits of Lancashire Dynamo & Crypto, Ltd., include one of twelve "Pony" motors for the 4,400 h.p. gas circulator motors for Bradwell power station. These motors have a nominal output of 30 h.p. at 575 r.p.m. and a very large starting and accelerating torque. The motors are capable of overspeeding to 3,800 r.p.m. Another exhibit demonstrates the company's synchronous squirrel cage motors incorporated in geared units operating at variable speed from a d.c. to a.c. rotary convertor giving variable frequency output.

A 250 kW silicon rectifier equipment is shown by the Rectifier Division of Lancashire Dynamo Nevelin, Ltd. This is typical of a number of contracts in hand for semiconductor power rectifiers. The company also shows a recently developed 30 h.p. 3-phase "Varimag" magnetic amplifier variable speed drive.

The Switchgear Division of Lancashire Dynamo Nevelin, Ltd., is showing a motor starter switchboard and the latest form of monitored earth safety unit, and, for the first time, a range of fuse distribution boards to be known as the "Oxted Minor" range.

Among new exhibits shown by Foster Transformers, Ltd., is the "Troidac" cast resin regulating transformer. Battery charging rectifiers for industrial and marine fields, including equipment for rapid battery charging and engine starting, are exhibited by Crypton Equipment, Ltd.

Langley London, Ltd., Kelvin Way, Crawley, Sussex.—**Stand K.8.**—Electrical insulating materials shown include mica and mica products, and the range of "Lantex" laminates of paper, fabric and glass with bonds of phenolic, polyester, ethoxylene, silicone and other resins.

Laurence, Scott & Electromotors, Ltd., Gothic Works, Norwich.—**Stand L.4.**—One exhibit which typifies the company's work in the field of special machines developed to meet specific requirements is a 250 h.p. 3,000 r.p.m. squirrel-cage motor. It has forced-lubrication of the bearings from a specially designed pump drive through spherical bevel gearing, with continuous filtration of the oil and is designed to run for a minimum of 2 years without shut-down. In contrast, two 75-year-old machines are shown.

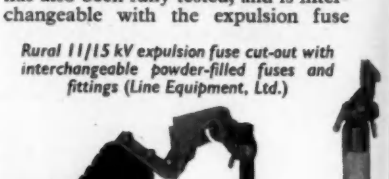
Lee Guinness, Ltd., Newtownards, Northern Ireland.—**Stand Q.9.**—On display for the first time are "Vapormatic" rotor starters for heavy duty applications, permitting frequent starting, and "Vapormatic" starters for the control of squirrel-cage motors. Other items are contactors, relays, isolators and accessories, all of which are available as separate components; exhibits illustrating special applications, including a large auto-transformer panel and crane control equipment; and selections from a range of standard automatic starters.

Lewden Metal Products, Ltd., 5, Argall Avenue, Lea Bridge Factory Estate, Leyton, London, E.10.—**Stand G.2.**—Weathertight fittings include switches, switch-plugs, sockets and plugs, cable couplings, plug adaptors, and tee couplings. There are also weathertight packing glands, flexible tubing adaptors, and armoured cable glands, in brass and zinc base alloy; bonding nipples; lug grip adaptors; flexible arm lamps; the patented "Ceiling Master" fittings; brass slotted conduit plugs; pottery lamps; switch boxes and plugs; and indicator pilot units.

Light & Power Accessories Co., Ltd., Wellesley Road, Wood Green, N.22.—**Stand G.20.**—Metalclad sockets and plugs; switches and switch sockets; watertight and weatherproof submersible accessories; and cable glands for all types of cables.

Line Equipment, Ltd., 32, Queen Victoria Street, London, E.C.4.—**Stand T.6.**—As specialists in the manufacture of h.v. air-break switch and fusegear for use outdoors on systems up to a maximum of 400 kV, the company exhibits a selection of its standard rocking and rotating type isolating switches for various voltages together with manual, spring and power operated mechanisms. The latest type of interrupter head for fitting to "Load Break" switches can also be seen, together with a complete spring operated fault throwing switch. Of special interest is a selection of h.v. fuse cut-outs. The expulsion fuse cut-outs have now been fully type tested to B.S. 2692 up to 150 MVA at 11 kV 3-phase. The first of a new range of powder-filled current-limiting fuses has also been fully tested, and is interchangeable with the expulsion fuse

Rural 11/15 kV expulsion fuse cut-out with interchangeable powder-filled fuses and fittings (Line Equipment, Ltd.)



holder of 11 kV cut-outs. Other exhibits include a new two-insulator centre break rotating type isolator with a completely new contact.

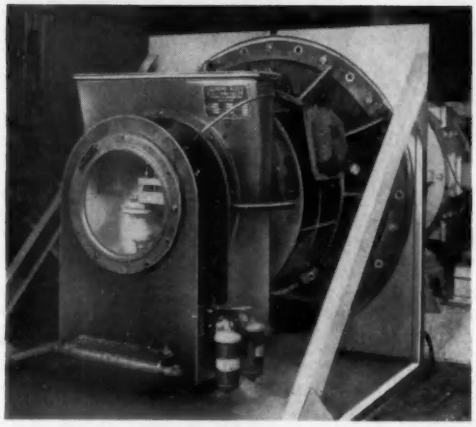
Linolite, Ltd., 118, Baker Street, London, W.1.—**Stand X.16.**—"Linolite" decorative fittings and reflectors employing filament tubular lamps; "Gaylite" contemporary laminated fabric shades; "Linora" small sectioned reflectors employing fluorescent lamps for commercial lighting; "Spotline" adjustable fluorescent reflectors; and "Linoglas" direction signs.

Lodge Plugs, Ltd., Rugby.—**Stand X.21.**—"Sintox" industrial ceramics and "Lodge" ignition equipment for the oil-firing, gas turbine and allied industries. Special igniters and probes, liquid level indicators, thermocouples and insulated lead through insulators and terminals are also shown.

Exhibits by Aish & Co., Ltd., of Poole, Dorset (also on this stand) comprise examples of control installations for oil or p.f. burners and sensitive flame failure controls.

Londex, Ltd., Anerley Works, 207, Anerley Road, London, S.E.20.—**Stand G.3.**—Dozens of different types of relays are displayed for a.c. and d.c. systems and new items include a multiple contact plug-in relay; a robust latching relay with electrical impulse reset; a plug-in hermetically sealed relay; and a busbar for d.c. current reversal. Photo-electric equipment has been extended to include a self-contained photo-transistor/counter unit capable of speeds up to five per second; also a smoke alarm device to comply with B.S. 2740. Other recent additions shown for the first time are an alarm bell operating on supply failure (it uses no batteries); combined push-button indicator lamps for control panels; pressure switches with stainless steel components; and a small size air-flow switch for air conditioning systems.

London Electric Wire Co. & Smiths, Ltd., 24, Queen Anne's Gate, Westminster, London, S.W.1.—**Stand K.10.**—The display includes products of the associated companies, Frederick Smith & Co., the Liverpool Electric Cable Co., Ltd., the Vactite Wire Co., Ltd., and Millett Levens Printed Circuits, Ltd., and covers "Lewcosol" and other "Lewcos" insulated wires and strips; "Anacos" bare copper and copper alloy conductors; "Salcos" aluminium wire and strand; rubber, thermoplastic, paper and cambric insulated cables and flexibles; "Vacrom" and "Eureka" resistance wires and tapes; Vactite alloy 653; molybdenum rods, wires and tapes and special wires for radio and electronic purposes; industrial nameplates, dials and scales in all metals and plastics; "Plasmet" etched circuits; strain gauges; cable forms; heating elements; code discs; and printed circuits.



Above: London Fan & Motor Co.'s 18in heavy duty propeller fan. Left: A 250 h.p. 3,000 r.p.m. squirrel-cage motor of special design for the U.K.A.E.A. (Laurence, Scott & Electromotors, Ltd.)

London Fan & Motor Co., Ltd., 27, Brecknock Road, London, N.7.—**Stand V.8.**—A selection of "Breeza" fans includes "Cadet," "Trojan," heavy duty and flameproof ranges for all duties, together with speed regulators, automatic louvred shutters and backdraught cowls. Fan sizes range from 6in to 30in diameter. Among new products are kitchen ventilators for canteen and domestic use; a light-duty "Man-cooler" with 12in fan which is easily portable or may be fitted to a wall; a range of industrial "Man-coolers"; and an air humidifier.

London Transformer Products, Ltd., Cobbold Estate, Willesden, London, N.W.10.—**Stand H.19.**—Technical staff are available to discuss customers' requirements of transformers in general, up to 5,000 kVA.

Long & Crawford, Ltd., Gorton Road, Manchester, 12.—**Stand U.3.**—New switchgear products include an outdoor 250 MVA circuit-breaker suitable for 6·6 to 11 kV; an oil fused-switch incorporating a fault-making earthing switch and interlocked cable facility; and a type ALD vertical isolation circuit-breaker unit, incorporating a type D2 circuit-breaker rated at 250 MVA at 6·6 and 11 kV.

Lord's Controls, Ltd., and A.C. Industries, 15, Victoria Avenue, Camberley. — **Stand X.11.** — Automatic mains failure control units; engine alarm indicators; switchboards; solenoids; and the "Reli-Alarm" safety units are shown by Lord's Controls. A.C. Industries present transformers; saturable reactors; flash test equipment; chokes and coils.

Lumitron, Ltd., 180, Shaftesbury Avenue, London, W.C.2.—**Stand S.19.**—A new style of multi-purpose suspended ceiling is featured. It has interchangeable plastic louvre panels and its lightweight suspension drops and bars are provided with a cavity for cables feeding the control gear. Fluorescent lighting fittings and a range of spotlights in contemporary styles are also exhibited.

Arthur Lyon & Co. (Engineers), Ltd., 6, Carlos Place, London, W.1.—**Stand J.25.**—Working demonstrations of the new series III and ES range of "Stamford" motor-alternator sets.

William McGeoch & Co., Ltd., 46, Coventry Road, Birmingham, 10.—**Stand E.9.**—The company is showing watertight sockets and plugs, switches and couplings, including multi-pin pattern sockets and plugs; b.c. lampholders (brass and porcelain); open type knife switches to 10,000 A; back of board switches and fusegear to 400 A; lighting fittings (watertight and weatherproof) including brass and cast-iron bulkhead and pendant fittings, decorative lighting fittings and electrical accessories; Bakelite mouldings, stampings and non-ferrous castings. Miniature multi-pin plugs and sockets (2 to 5 A) are among new products.

Robert Maclaren & Co., Ltd., Eglinton Works, Kilbirnie Street, Glasgow, C.5.—**Stand G.18.**—An

Right: McGeoch miniature multi-pin plug and socket (112 pin). Below: The new Londex self-contained photo-transistor/counter unit

entirely new series of "Convectorstats" designed for electric space heating equipment has been introduced. Two patterns are available—the "MCA 65" with a range of 65 deg F and the "MCA 100" having a range of 100 deg F. Both patterns are single hole fixing with an earthed bimetal operating a positive acting snap switch. Other exhibits include the type "MO" oven thermostat; a dual purpose thermostat for greenhouse use, the type ACS-G rod pattern for the control of either air temperature or soil warming; the type MB domestic water heating thermostat; and the "Thermo-Time" regulator.

Magicook Appliances, Ltd., Shirland Mews, London, W.9.—**Stand H.6.**—"Magicair" fan heaters; "Magicook" infra-red cookers; "Princess 600" infra-red domestic grills; and the recently introduced "Popular" fan heater.

Magnetic Devices, Ltd., Exning Road, Newmarket, Suffolk.—**Stand Q.5.**—Solenoids particularly applicable to computers, office machines and light electromechanical equipment are shown in addition to a wide range of relays and relay control boxes.

Major Equipment Co., Ltd., 22, Gorst Road, Park Royal, N.W.10.—**Stand H.2.**—Fluorescent fittings; exterior and interior signs; neon displays; cold cathode tubular lighting; and stage lighting equipment.

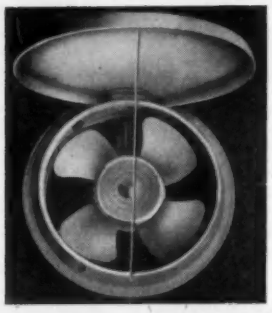
Mantel Metalworkers, Ltd., 50, Stuart Road, London, S.E.15.—**Stand F.13.**—External access meter cases, recently introduced by the company, are included in a display of consumers' control units, service units, rising main systems, skirting trunking, busbar chambers, instrument cases, etc.

Marbourn, Ltd., Roslyn Works, Roslyn Road, South Tottenham, London, N.15.—**Stand F.1.**—A wide range of "Marbo" electrical wiring accessories contains several new items, including the "Handy-Twin" 13 A socket-outlet adaptor; 13 A plaster-depth flush switch-socket; and a plaster-depth 2-gang flush socket to match plaster-depth flush switch units.

Marryat & Place, Ltd., 40 Hatton Garden, London, E.C.1.—**Stand D.2.**—The "Barduct" busbar system of electrical distribution employs fused tapping boxes and is particularly suitable for installation in machine shops and other situations where quick and convenient connection to the electrical supply is required. It is available in ratings up to 250 A per phase and employs fully shrouded conductors.

Martindale Electric Co., Ltd., Westmorland Road, London, N.W.9.—**Stand G.6.**—Portable electric blowers; commutator grinding stones and grinders; sirens; and general protective equipment are included in this company's display. A new industrial cleaner and a fixed prod voltage tester are shown for the first time.

M.C.B. Co. (Manchester), Ltd., Oxford Road, Altrincham, Cheshire.—



Above: Metway Electrical Industries "Coolerway" extractor fan

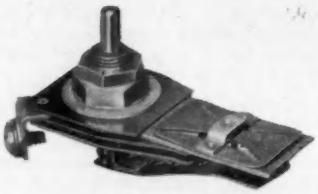
Right: Lupus "Electric-Kindler" fire lighter (M.C.B. Co. (Manchester), Ltd.)

Stand F.20.—A range of "Lupus" miniature circuit-breakers, from 5 to 60 A, double- and triple-pole designs, is shown in addition to distribution gear. New products include the "Midget" m.c.b., produced in a universal pattern suitable for front or back cable entry. Simple adaptors enable the unit to be readily converted to either "standard" busbar fitting, single or double plug-in pattern, or back stud mounting. Another new device is the "Electric-Kindler" for lighting domestic coal fires.

M. & C. Switchgear, Ltd., Kelvinside Works, Kirkintilloch, Glasgow.—**Stand K.24.**—Among the switch and control gear on this stand are the "Unicube" type D464 m.v. group control motor starter assembly comprising a series of standard cubicle units built into board formation; the D431 unit type motor control and distribution gear; oil-break switchgear, of which the type D202, 200 A 660 V breaker is a typical example of certified flameproof equipment; and a varied selection of push-button switches for use with automatic push-button starters and control gear and for the remote tripping of circuit-breakers.

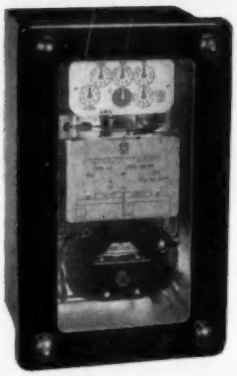
Meritus (Barnet), Ltd., Wood Street, Barnet, Herts.—**Stand R.1.**—A selection of machines from the range of "Meritus" resistance, spot and seam welders and ancillary equipment includes a 60 kVA machine with Ignitron contactor. Two new additions are Model P.B.3 foot operated butt welding machine and a bench type spot welder complete with cycle timer. A high current neutral loop impedance and continuity tester is also shown, as well as a selection of low voltage lighting equipment.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, 17.—**Stand A.2.**—The principal exhibits are a 132 kV air-blast circuit-breaker, type GA, and a type "M21" resistor-



Maclaren type MCA "Convectorstat"

Meritus model NL4 high current neutral loop impedance and continuity tester



Met-Vick type NF4 meter arranged for flush or projecting switchboard mounting

transition on-load tap changer for use with transformers up to 20 MVA, 33 kV (this exhibit has glass covers so that the mechanism can be seen in operation). The display of motors includes a 30 h.p. ventilated squirrel-cage machine; a 60 h.p. flameproof squirrel-cage motor; a 3 h.p. type KNX-B 204 motor; a 10 h.p. type KNC 215 motor; and a 3 h.p. type KVN-C 184 D motor. Infra-red projectors, mounted on slotted angle to form an oven, and a display of tubular sheathed industrial heating elements are shown, as well as "Redring" radiant boiling plates. Switchboard and control board pattern indicating instruments include the new type SN rotary synchroscope. Among integrating meters there are the type MF5 single-phase house service pattern meter and the types NF3 and NF4 polyphase meters. There is also a new type RB mine-hoist chart recorder and a cage speed recorder.

Metway Electrical Industries, Ltd., Metway Works, Canning Street, Brighton, 7.—**Stand N.11.**—Among the wide range of products shown are heating elements (industrial and domestic); wiring accessories; terminal blocks in p.v.c., rubber and nylon; kettles; irons; fires; health lamps; and domestic and industrial infra-red heaters. The largest part of the exhibit is devoted to the "Coolerway" extractor fan, now available with a three-speed matching regulator.

Micanite & Insulators Co., Ltd., Blackhorse Lane, Walthamstow, London, E.17.—**Stand T.2.**—Micanite in the form of V-rings, covered bars, segment separators, etc., and "Paxolin" synthetic resin bonded laminates in a variety of moulded, punched and machined parts are displayed. More specialised materials include "Samica" mica paper insulation of various types; "Melinex" faced micanite; silicone insulation for Class "H" applications and copper faced "Paxolin" for printed circuits. Empire varnished insulation is shown in the form of sheets, tapes and punchings.

Midland Electric Manufacturing Co., Ltd., Reddings Lane, Tyseley, Birmingham, 11.—**Stand D.7.**—New switchgear products include a range of "Kantark-Exel" 500 V fuseboards (15-200 A), for use with rewirable or h.r.c. cartridge fuses, designed to comply with B.S. 88, Clause J dimensions. There is also a preview of a forthcoming range of "Memrex-Exel" and "Memrex-Senior-Exel," 500 V industrial switches and switch-fuses in sheet steel cases. Protective motor control gear for motors between ¼ and 15 h.p. is displayed as well as a comprehensive range of electrical accessories. New heating appliances include the "Flamenco" wrought iron radiant fire screen and a restyled "Rotovair" fan heater.

Midland Silicones, Ltd., 68, Knightsbridge, London, S.W.1.—**Stand C.10.**—The main emphasis is centred on recent applications of silicone insulated motors, transformers, and cables.

M.K. Electric, Ltd., Wakefield Street, Edmonton, London, N.18.—**Stand D.5.**—Two new additions to the company's range of electrical accessories for domestic and industrial installations are the round-pin switch-socket-outlets with 2⅜in fixing centres suitable for mounting in the B.S. 1363 box) and a range of fused spur-boxes with double-pole switches for use on the installation of fixed appliances to conform with the I.E.E. Wiring Reg. 314.

Morecambe Electrical Equipment Co., Ltd., Westgate Works, Morecambe. — **Stand T.4.** — Multi-motor control boards, specially designed to customers' requirements, and various types of starting equipment and contactors are exhibited together with the latest development of unit type construction which can be readily assembled and extended, by customers, to meet changing factory requirements.

Morphy-Richards, Ltd., St. Mary Cray, Kent.—**Stand K.9.**—A comprehensive range of domestic electrical appliances includes a new 22in heat-controlled, foot operated rotary ironer; electric irons; automatic toasters; hair dryers; food mixers; door chimes; radiant fires and convectors; electric under-blankets; refrigerators and spin dryers. The company's "Super-Suction" cleaner is also demonstrated.

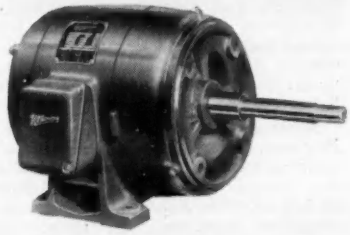
M.T.E. Control Gear, Ltd., Leigh-on-Sea, Essex.—**Stand H.8.**—The main feature of this stand is a demonstration of "Progress Range" control gear components including contactors, multiple relays, timing relays, overloads, and single-phasing protection, which takes the form of a "noughts and crosses" game. "Discmag" electromagnetic brakes for a.c. motors up to approximately 10 h.p. are also demonstrated.

Mycalex & T.I.M., Ltd., Ashcroft Road, Cirencester, Glos.—**Stand J.5.**—"Mycalex" and "Mycalon" mouldings are displayed, together with samples of moulded sheet. Other exhibits include moulded arc shields for use in contactors and switchgear assembly and a range of ultra f.h.p. shaded pole motors. Among new products are T.I.M. test bench appliance connectors.

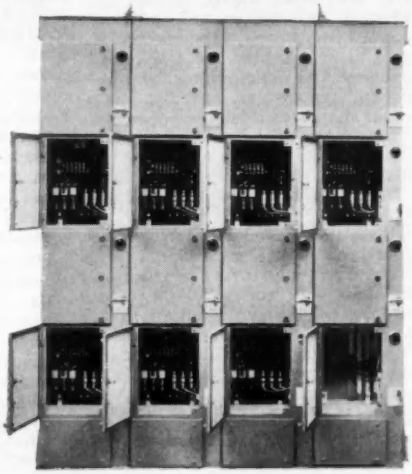
Nalder Bros. & Thompson, Ltd., Dalston Lane Works, London, E.8.—**Stand F.12.**—Electrical instruments for all measurements include round, square, edgewise and sector types and also show the modern appearance with platform scales, sword pointer, centre of glass zero adjustment, combinations of which may be varied to suit requirements. There is a range of protective relays for either instantaneous or time delay operation and miniature circuit-breakers are shown in single-, double- and triple-pole units. New products include 3½in edgewise ammeters and voltmeters with illuminated dials.

National Pressure Cooker Co. (England), Ltd., Pelham Street, Wolverhampton.—**Stand X.18.**—A full range of "Presto" products consisting of pressure cookers, coffee-makers, and the new automatic electric cooking appliances.

Nettle Accessories, Ltd., Harper Road, Wythenshawe, Manchester, 22.—**Stand J.13.**—A pendant push-button unit (neoprene-clad) for controlling cranes and similar equipment can be seen in action. Other new products include a fused spur connector; an architectural fitting to suit small circular b.c. lamps; contemporary



Newman close coupled pump motor—drip-proof enclosure



An M. & C. Switchgear 24-unit "Unicube" group control starter board. Right: Morecambe unit type construction control board

styled lampholders; coloured fused 13 A plug tops; a replacement fuse "bubble" pack; wall brackets; and one- or two-gang plaster-depth 13 A sockets; bi-pin lampholders suitable for fluorescent fittings are also shown.

Newman Industries, Ltd., Yate, Bristol.—**Stand J.1.**—Examples of all the company's electric motors, from $\frac{1}{6}$ to 600 h.p., are on view. A range of totally enclosed motors in N.E.M.A. "66" frame dimensions and with ratings of $\frac{1}{2}$-1$\frac{1}{2}$ h.p. single-phase (capacitor start) and $\frac{1}{2}$-2 h.p. three-phase is designed to bridge the gap which usually exists between f.h.p. and the smallest industrial motors. Of special interest to machine tool and hoist manufacturers is a range of motors (drip-proof or totally enclosed) incorporating an electromagnetic brake designed on the disc principle and actuated by the normal a.c. supply. The third new product shown is a close-coupled pump motor with a specially designed shaft extension on to which the pump impeller can be directly mounted. The motor exhibited has a drip-proof enclosure ($\frac{1}{2}$-40 h.p. 3-phase) but it can also be supplied totally enclosed or flameproof/explosion proof.

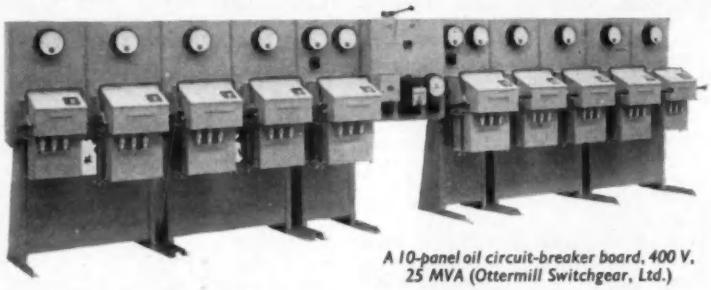
Nife Batteries, Redditch, Worcs.—**Stand K.2.**—A number of newly designed self-contained equipments including the standard 30 V 10 A/hr tripping unit and 25 V minor emergency lighting unit are displayed. Among other items exhibited are a 110 V switchgear operating battery, complete with control and charging equipment; stationary batteries for marine purposes, traction applications, electric starting and telephone equipment; and portable lamps and floodlight sets.

Northern Aluminium Co., Ltd., Banbury, Oxfordshire.—**Stand Y.10.**—Chief among the company's exhibits are "Noral" aluminium transmission and distribution line fittings which are displayed together with tools and general accessories. These fittings include the new "Noralgrip" range which are shown being applied to conductors by means of a new motorised compressor. Prominence is given to a display of "Noral" aluminium and aluminium alloy busbars in rectangular, tubular and channel shapes and to accessories for use with them. A jointing compound, specially recommended for bimetallic joints, is also shown. A new product is "Noralduct" roll-bonded sheet which has integral passageways. Originally developed for refrigerator evaporators, it has wide application for heat exchangers. As a producer of aluminium wire and tube, the company is exhibiting a selection of insulated cables with aluminium conductors and sheaths. A method of making joints on aluminium cables is also demonstrated.

N.S.F., Ltd., Ingrow Bridge Works, Keighley, Yorkshire.—**Stand S.2.**—"Cutler-Hammer" appliance switches are displayed, together with "Oak" rotary wafer and push-button switches.

Otter Controls, Ltd., Market Street, Buxton.—**Stand X.13.**—Safety cut-outs and snap action thermostats up to 20 A 250 V a.c. are shown. The type T range of miniature thermostats is extensively used for temperature control in radar equipment, guided missiles, etc. Other types of thermostats for electric motor protection, immersion heaters, convector heaters, etc., as well as choke control thermostats, are also exhibited. A new product, the "Blanketstat," gives extra close temperature control of p.v.c. covered heating wires.

Ottermill Switchgear, Ltd., 82, Victoria Street, London, S.W.1.—**Stand G.9.**—A section of 800 A rising-main busbar trunking showing expansion units and fire resisting barrier, and a floor distribution unit incorporating h.r.c. fuse switches and miniature circuit-breakers are exhibited. Trunking systems are available for inspection, as well as cable trunking and accessories with examples of underfloor skirting ducting. Switchboards of the industrial and cubicle type are shown and a unit from each frame size of oil circuit-breaker, with examples of drawout and non-drawout patterns, are mounted on one display unit for close inspection. New products include an 800 and 1,200 A switchboard mounting drawout unit.



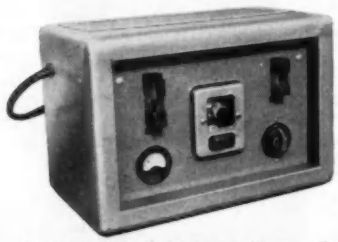
A 10-panel oil circuit-breaker board, 400 V, 25 MVA (Ottermill Switchgear, Ltd.)

Parkinson Cowan Instruments, Fitzalan Street, Kennington, London, S.W.11.—**Stand R.4.**—A system for centralised control for street lighting and multi-services over the 50 c/s power distribution network is shown for the first time.

Parmeko, Ltd., Percy Road, Aylestone Park, Leicester.—**Stand Q.6.**—Transformers for industrial and electronic purposes are shown, together with examples of the company's recently developed magnetic amplifier equipments.

Parmiter, Hope & Sugden, Ltd., Longsight, Manchester, 12.—**Stand D.9.**—New developments are a range of "Fluvent" distribution boards incorporating principles of front wired construction which enable spare circuits to be cabled with the busbars "alive," and the QC range of "Aeroflex" fuse-links designed for the protection of semiconductor diodes. Heavy-duty fuse-switches and a new associated range of AC5 fuse links to B.S. 88, Appendix J, are also shown. Other exhibits include cubicle and unit type switchboards; power pillars; special distribution pillars; distribution boards with isolators; insulated house service and street lighting fuses; and a flameproof unit switchboard and distribution board with isolator. A display of castings in grey iron and "Nicon" (non-magnetic iron) and a range of cast nameplates for electric motors, produced by J. F. Collier & Co., Ltd., a subsidiary company, is also shown.

Partridge, Wilson & Co., Ltd., Evington Valley Road, Leicester.—**Stand H.7.**—Rectifying apparatus, power distribution transformers, and automatic battery chargers, are among the products exhibited on this stand. Of special interest is the "Davenset" automatic vehicle charger fitted with germanium rectifier cells and the example displayed is designed for charging a battery of 36 lead acid cells with a capacity at the 5 hr rate of 216 Ah. The germanium rectifier has about five times the output per cubic volume of a selenium rectifier and it therefore enables a much smaller and lighter design to be made. The model illustrated is only 18½in high by 24½in wide by 15½in deep.



Partridge, Wilson & Co.'s "Davenset" germanium vehicle charger

P. & B. Engineering Co., Ltd., Crompton Way, Crawley, Sussex.—**Stand V.9.**—A representative selection of P & B-Golds relays for the close protection of polyphase motors is shown, in addition to stalling relays. Other exhibits include thermal relays, in single or polyphase forms for the protection of transformers; maximum demand and load indicators; "Easifix" current transformers; live-line taps, and fibreglass operating poles; a cable spiker; a cable tracer and fault locator;

and a capacity measurer for locating open-circuit faults in cables. Earth clamps for use on e.h.v. outdoor gear showing new designs of operating heads and glass-fibre operating poles in use on model busbars form a special feature.

Permali, Ltd., Bristol Road, Gloucester.—**Stand N.6.**—A cinema on this stand shows the latest range of insulating materials offered and their applications in the electrical industry. New exhibits include a range of "Dialam" s.r.b.p. bushings designed to the new C.E.M.A./N.E.M.A. specifications and a glass-fibre air baffle of an expanded-core design. Other items include several intricate dough moulded insulators. Examples of densified wood laminates shown are alternator brackets, arc control pots, lift bars, stay-wire insulators and tap-changer switch parts. Emphasis is given to loaded components in the "Permaflon" p.t.f.e. display.

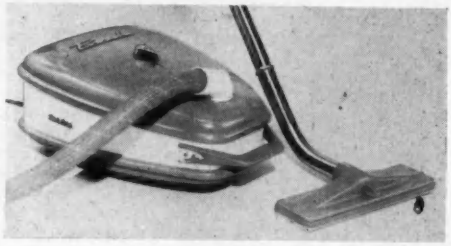
Permanoid, Ltd., New Islington, Manchester, 4.—**Stand F.15.**—The main feature on this stand records the original pioneering work of the company in the field of plastic cables, wires and insulating sleevings, and illustrates the development programme which has been undertaken to improve the electrical and physical characteristics of p.v.c. and polythene cables, particularly at high operating temperatures. Exhibits include "Permathene" general wiring cable for domestic and industrial power and lighting; Gulf "Permathene" cables for operation in high temperatures; armoured power and control cables; super flexible cables; connecting wires; single and twin screened cables; h.t. leads; and h.p. cables and television downleads. A method of stripping the plastic sheath of general wiring cables and a range of very fine connecting wires for the wiring of deaf aid equipment and small electronic gear are among new products.

Philips Electrical, Ltd., Century House, Shaftesbury Avenue, London, W.C.2.—**Stand K.13.**—A wide range of new bi-pin fittings and shop window lighting fittings is shown. Incorporated in the stand is a display of ultra-violet radiation, and special areas are devoted to colour reproduction. Applications of infra-red heating are also demonstrated. Other items include a fluorescent inspection hand-lamp; a high intensity narrow beam spotlight; polyester ballasts and rotor type lampholders; pressed glass lamps; reflector lamps; fluorescent fittings; and asymmetric car bulbs.

Pinchin, Johnson & Associates, Ltd., 4, Carlton Gardens, London S.W.1.—**Stand V.4.**—Electrical insulating varnishes, lacquers and compounds.

Pirelli-General Cable Works, Ltd., 343-345, Euston Road, London, N.W.1.—**Stand R.10.**—Flexible cords, wiring cables, mains and super-voltage cables and cables for railway electrification are shown. Of special interest is the 330 kW oil-filled cable installation for the Snowy Mountains Hydro-Electric Authority. Jointing demonstrations include the making of cast-resin joints on plastic mains cables.

Process Control Gear "Proscon" clamp-on type thermostat



Parnall "Tenten" vacuum cleaner (Electrical Division of Radiation, Ltd.)

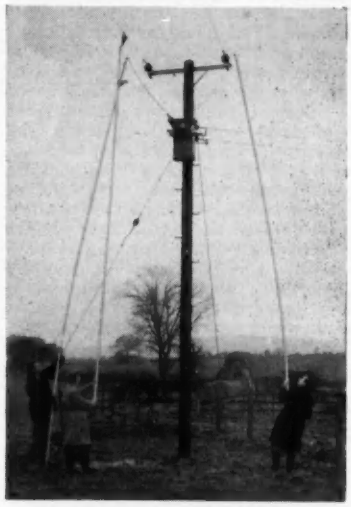
Plessey Co., Ltd., Ilford, Essex.—**Stand V.5.**—Mains transformers, including a new shrouded "C" core range are shown by the Components Group. The Wiring and Connectors Division is exhibiting a wide range of plugs and sockets, high temperature connectors, and pre-formed wiring systems.

Poles, Ltd., Tyburn Road, Erdington, Birmingham.—**Stand M.4.**—Models and photographs show some of the applications of poles to electrical engineering, including overhead electric power lines, telecommunication lines, street lighting, high level flood-lighting and radio masts.

Portaway Earthing Equipment, Ltd., 2, North Park Road, Harrogate, Yorkshire.—**Stand D.1.**—The "Portaway" earth-continuity and bending system now comprises a range of seven sizes of earthing conductors specially designed and made for the more efficient use of h.c. copper, saving in erection costs and lower inspection costs (sizes 0·015 up to 0·5 sq in). A series of "Portaway-Fulgrip" bonding clamps include a right angle clamp and the crosswise clamp for connecting conductors at right angles when forming an earth mat, etc. Other items are the "Dyrod" earth electrode range and the "Topon" vitreous earthenware electrode cover.

Power Centre Co., Ltd., Lloyd Street, Wednesbury, Staffs.—**Stand J.12.**—Industrial electrical distribution gear comprising busbar trunking, cable trunking, cable tap systems, fuse units, cable boxes and accessories, etc.

Power Connectors, Ltd., 2, Caxton Street, Westminster, London, S.W.1.—**Stand G.16.**—Power terminating and connector equipment for overhead lines, substations, distribution switchgear, earthing and special applications. Exhibits include 4,000 A busbar clamps for power substations and 1,200 A bi-metal expansion fittings. Switchboards, control cubicles, instrumentation panels and other items of l.v. distribution equipment are also displayed.



Permali "Permaglass" live-line poles shown in use

Preformed Line Products (Great Britain), Ltd., Andover, Hampshire.—**Stand S.5.**—Various accessories, claimed to be a revolutionary development in transmission line practice in this country, are on view. Among the accessories are such items as armour rods, line guards, line splices, patch rods, dead ends, guy-grips, armour grip suspension units, splice shunts, and bundled conductor spacer units.

Pritchett & Gold and E.P.S. Co., Ltd., Dagenham Dock, Essex.—**Stand M.6.**—Stationary batteries for emergency lighting duties and aircraft and tractor batteries.

Process Control Gear, Ltd., Lattimore Road, St. Albans, Herts.—**Stand J.4.**—A comprehensive range of "Proscon" thermostats includes room thermostats, air thermostats, immersion thermostats and all types of industrial thermostats. A new clamp-on thermostat and type PM immersion thermostat are also exhibited.

Pyrotenax, Ltd., Hedgeley Road, Hebburn-on-Tyne. — **Stand G.7.** — Mineral insulated copper covered cables.

Radiation, Ltd. (Electrical Division), 255, North Circular Road, Neasden, London, N.W.10.—**Stand W.4.**—Pride

of place is given to the new Parnall "Tenten" vacuum cleaner and the Jackson "202" 2 cu ft refrigerator. Home laundry equipment shown includes the Thor "Automagic" washer, the EW51 electric washer, the TD55 "Auto-Dry" and the "Ezy Press" ironer. There is also a full range of Jackson cookers, including the "396" eye-level-grill cooker, the new "395" and the popular "394" models. Jackson "Jill" water heaters and fires form a wall display.

Radiovisor Parent, Ltd., Stanhope Works, High Path, London, S.W.19.—**Stand U.7.**—The latest version of the industrial smoke density indicator/alarm type RV.2 and the simpler smoke alarm unit type SA.56 are exhibited as demonstration models with accompanying recorders and indicators. Typical weld timers are demonstrated and level controls vary from the straight-forward electrode conductivity units to special photo-electric modulating equipment. A standard photo-electric counter is shown which incorporates the company's plug-in "Spadelok" chassis feature, and other exhibits are "Pyrostat" temperature controllers; a print registration unit; burglar alarms; flame failure protection equipment; and a new economic temperature controller, the TC.58, which covers a range of 80 to 300 deg F.

Ranton & Co., Ltd., Commerce Road, Brentford, Middlesex.—**Stand A.10.**—Electrical accessories include lampholders, plugs, etc. A 30 A ring main junction box is among new products.

Rawlplug Co., Ltd., Cromwell Road, London, S.W.7.—**Stand L.3.**—Apart from the many Rawlplug fixing devices and tools there is an attachment for converting an electric drill into a power hammer, the blows of which can be set at light, medium or heavy. Special hammer drills, sizes No. 6 to No. 22, are provided. The "Vibroto" 3 in 1 drilling machine, also shown, is an electric power tool which combines a high rate of vibration with rotation to enable specially made hard tipped drills to bore holes in concrete.

Record Electrical Co., Ltd., "Cirscale" Works, Broadheath, Altrincham, Cheshire.—**Stand B.7.**—"Cirscale" indicators with 2¾ to 30in dials may be seen. Models include shockproof, weatherproof and hermetically sealed types. Tachometer indicators are specially featured, together with a full range of a.c. and d.c. transmitters. In addition to "Cirscale" ammeters, voltmeters, wattmeters, frequency indicators and p.f. indicators the graphic recorders, with various improvements to the chart drive, are noteworthy. Among new products are a low-speed tachometer indicator using a 6-phase transmitter; and a step-down transformer to enable the clip-on graphic recorder to be operated from a 5 A current transformer secondary.

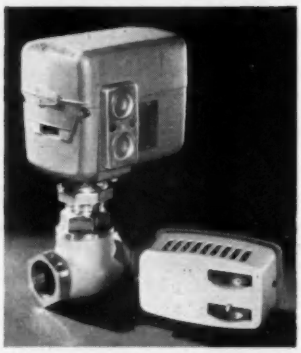
Revo Electric Co., Ltd., Tipton, Staffordshire.—**Stand F.8.**—Switchgear exhibits include a new range of "Magna" switch-fuses (s.p. and n., d.p., t.p., and t.p. and n.), all 500 V, 15 to 100 A. In addition, "Silvertip" switch-fuses and splitters, and "Safeway" distribution boards are displayed. Among industrial lighting and control gear exhibits is a new polyester filled control gear in which the coil and core are completely surrounded with polyester resin, preventing atmospheric deterioration and ballast hum. New to the public lighting range is the C15344 "Horizon" lantern for use with Mercury/fluorescent lamps. In this fitting the refractor is specially designed to give optimum light control and is made of heat resisting glass. A further selection of equipment includes lanterns for sodium, mercury, tungsten and fluorescent lamps. The "Ariel" ceiling fan, lately restyled and offered in a range of colours, is shown, together with the range of desk fans.

Domestic appliances which the company has recently introduced include the "Revo-Luxe" remote-control electric cooker; portable and wall mounted electric fires; electric irons; electric kettles, etc.

A. Reyrolle & Co., Ltd., Hebburn, Co. Durham.—**Stand H.18.**—New switchgear units include a high-speed auto-reclosing outdoor pole-mounting circuit-breaker (200 A, 75 MVA at 11 kV). It is spring-operated, the spring being automatically charged electrically from the h.v. supply (11 kV or 14·4 kV) after each trip during the one-second dead-time interval between reclosures. Provision is made for three reclosures with lockout after the fourth trip, after which the mechanism must be reset by hand by an external lever. A new addition to the "J" range of outdoor rural switch and fuse units consists of a 100 A oil-break fuse-switch incorporating rewirable fuse-links with a breaking capacity of 150 MVA at 11 kV. It will also take cartridge fuse-links of 250 MVA rating. Protective relays, l.v. switch and fuse units with interlocked plugs, and industrial plugs and sockets are also shown.

Reyrolle type JT 11 kV outdoor oil-immersed fuse switch

Rheostatic Co., Ltd., Slough, Bucks.—**Stand M.12.**—A new instrument, production of which has just started, is the "M" motorised valve, used to control the output from individual radiators or multiple zones of a hot water or steam heating system. A companion instrument, the "TL" room thermostat, has a built-in thermometer and is fitted with an accelerator heater for increased sensitivity, with a night set-back heater, when required, for automatic night setting. A display of the instruments recently designed and produced by the company is shown, in addition to the "Duotronic" two-term electronic temperature control system; a range of oven thermostats and "Superswitch" boiling plate controls; and "Satchwell" automatic controls, including motorised valves, oil burner controls, thermostats and other devices for heating, cooling and industrial processes.

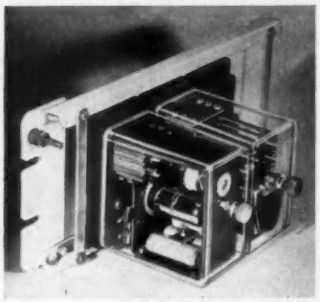


Rheostatic Co.'s "Satchwell" M motorised valve and TL room thermostat

Rist's Wires & Cables, Ltd., Lower Milehouse Lane, Newcastle, Staffordshire.—**Stand R.9.**—The display includes a full range of house wiring cables and flexibles, and cables used extensively in the electrical and electronic industries. Of particular interest are soil-warming cables of a design used for the Everton football ground. Fully terminated cable assemblies are also shown.

Robert Ritchie (Electrical), Ltd., 22, Mincing Lane, Blackburn.—**Stand Y.4.**—Apart from a comprehensive range of a.c. motor control gear, nine matching sizes of contactor from 10 to 200 A are displayed and starter combinations cover direct-on-line, automatic star-delta, reversing speed-changing, automatic stator rotor and auto-transformer patterns. Rotary switches, in 15, 40, 60 and 100 A sizes, are offered in a variety of circuit arrangements. Limit switches, foot switches, push-button units and accessories are also displayed.

D. Robinson & Co., 717, London Road, Hounslow.—**Stand Q.14.**—An extensive display of Clifford & Snell relay systems includes large and small plug-in relays; a variety of relay mounting frames; relay terminal blocks; annunciator facias; and plug-in flasher or time delay units. Two completely new units are a plug-in latching relay, so arranged that the



C. & S. plug-in electronic slugging unit mounted with the plug-in relay it controls (D. Robinson & Co.)

contacts are operated on a momentary pulse to one coil and restored by a momentary pulse to a second coil; and a plug-in electronic slugging unit which will "slug" or delay the operation of a relay for anything up to 2½ minutes or, with the addition of an external condenser, up to two hours.

Rodene Electrical Co., Ltd., 579, London Road, Isleworth.—**Stand Q.14.**—Process timing equipment includes a new self-clutching timer motor; a timer motor with torque limiter; multi-circuit timers; and the "70" and "25" series of auto-reset timers. An electric stop-clock and a miniature multi-circuit timer are shown for the first time.

Rolco Engineering, Ltd., 407, Hornsey Road, London, N.19.—**Stand P.11.**—Shaded pole f.h.p. motors for blowers, electronic apparatus, fan heaters, tape recorders, remote controls, etc., and the "Rolco" universal mains convertor.

Rosite, Ltd., Cheney Manor, Swindon, Wilts.—**Stand V.5.**—Cold-moulded materials for the electrical industry on display are claimed to be non-tracking, heat resistant, arc resistant and dimensionally stable at high temperature, making them suitable for many applications including general purpose electrical insulators, insulators in arcing zones and insulators for high temperature uses. Typical examples include resistor formers and terminal blocks for electric cookers and arc shields and chutes for contactors.

Ross, Courtney & Co., Ltd., Ashbrook Road, Upper Holloway, London, N.19.—**Stands S.24 & S.25.**—Wire end terminals; solder tags; terminal tags suitable for crimping; crimping tools; pillar terminals; brass and copper cable sockets; steel cable clips; buckle clips; battery charging clips; fuse clips; h.v. terminals; cable connectors; capstan and automatic turned parts and presswork.

Rowlands Electrical Accessories, Ltd., Hockley Hill, Birmingham, 18.—**Stand D.4.**—Among a range of industrial and commercial lighting fittings are "Reflectortight" fittings, including

Rowlands "R.E.A.L." low-voltage narrow beam lantern

a special model designed for "clean conditions" use for nuclear power stations; "R.E.A.L." floodlanterns in a variety of models covering upward or downward lighting in conjunction with tungsten, mercury or sodium lamps, special attention being drawn to a new low voltage narrow beam lantern designed for ships' use or for mounting on cranes; and "Realite" shop window fittings, including a new range of louvred directional trough fittings in 5, 4 and 2ft sizes.

Sam's Electrical (London), Ltd., 9/11, Tabernacle Street, London, E.C.2.—**Stand Q.12.**—Electrical accessories and counter-balanced switches.

Sangamo Weston, Ltd., St. George's Court, 22-26, New Oxford Street, London, W.C.1.—**Stand E.4.**—A special feature of the company's time switch display is the newly introduced spring-reserve switch and examples of both 24-hour and solar dial types are shown. Single-phase and polyphase watthour meters, as well as metering accessories such as current transformers, test blocks and rotating substandards are to be seen. Among "Weston" electrical measuring instruments is the averaging resistance bulb and its associated "Tankside" indicator. The equipment indicates the average temperature of the contents of a liquid storage tank and is of particular interest to oil companies.

Wm. Sanders & Co. (Wednesbury), Ltd., Falcon Electrical Works, Wednesbury.—**Stand K.3.**—A comprehensive display of industrial and domestic switch and fuse gear includes cubicle and unit type switchboards; "Sandaclad" h.r.c. fuse switches; "Sandaclad" "Isoearth" switch; "Sandasteel," "Sandalita" and "Sandaline" fuseboards; consumer units; cooker control units; wiring accessories; rubber plugs; h.r.c. cartridge fuse links; and busbar chambers. The "Sandaline" fuseboard can now be supplied in a range covering 20 to 200 A.

Joseph Sankey & Sons, Ltd., 168, Regent Street, London, W.1.—**Stand K.11.**—On this company's stand are displayed endplates; insulators; riveted cores; argon-arc and submerged-arc welded stator and field cores; aluminium die-cast rotors; inter-laminar insulation, including D.R.N.S. inter-laminar insulation which, whilst retaining the insulation properties of "Insuline," has the added advantage of remaining unimpaired at re-annealing temperatures; and a recently introduced form of ductile electrical steel known as Stalloy 92 and 86 (Ductile) for use in the manufacture of laminations.

Santon, Ltd., Somerton Works, Newport, Mon.—**Stand J.20.**—A selection of thermal storage water heaters ranging from 1½ to 100 gal includes examples of the "Lincoln" heater with the new Stelvetite p.v.c. finish. Domestic immersion heaters in a variety of lengths and loadings and industrial types designed for the heating of bulk hot water, oils, caustics, acids, etc., are shown as well as automatic hot water circulators in loadings from 3 kW to 90 kW. Rotary switches ranging from 10 to 500 A include examples of a new lockable handle switch.

Julius Sax & Co., Ltd., 24, Commerce Road, Brentford, Middlesex.—**Stand X.9.**—Fire alarm apparatus, staff location systems, burglar alarms and a complete range of domestic bells, indicators and relays.

George H. Scholes & Co., Ltd., Wylex Works, Wythenshawe, Manchester, 22.—**Stand D.8.**—"Wylex" small switch and fusegear includes switch-fuse control units, all-insulated and metalclad, with rewirable and cartridge fuses, assembled with any number of fuses up to 8-way; the "Extenso" system for extensions to existing fuse unit installations; "Wylex" and "Sonex" cooker control units; 30 and 60 A d.c./a.c. switches; and a 20 A t.p. 500 V isolator. Among accessories there are the "Wylex" dual plug system for

Wm. Sanders "Sandaline" fuseboard

ring main and non-ring main; clock connectors, etc. A range of 20 A switches, with and without pilot light, for fitting in the standard ring-main box is shown for the first time.

Scottish Cables, Ltd., Deanside, Renfrew.—**Stand A.1.**—Cable exhibits include p.i. types up to 33 kV; plastic sheathed power cables; rubber insulated cables for distribution, industrial and mining purposes; and a wide range of plastic insulated cables including multicore cables for communications.

Shell Chemical Co., Marlborough House, 15-17, Great Marlborough Street, London, W.1.—**Stand X.7.**—The potting and laminating uses of "Epikote" epoxy resins in the electrical industry are illustrated and exhibits include transformers, capacitors, etc., for h.v. applications potted in the resins.

Siemens Edison Swan, Ltd., 155, Charing Cross Road, London, W.C.2.—**Stand J.14.**—An industrial cell (type WMN25) approximately 1 ton in weight forms an interesting exhibit. A new range of emergency lighting equipment of the compact floater type is also shown as well as a complete range of battery chargers and a germanium rectifier.

The Electrical Accessories Division features lampholders, cooker control units, switchsocket outlets, ring main accessories, etc. Telephone equipment; an audio frequency staff location system; loudspeaker telephones; and public address amplifiers are also shown.

Siemens-Schuckert (Great Britain), Ltd., Great West Road, Brentford.—**Stand J.17.**—Exhibits are divided into two main groups, industrial and flameproof switchgear and electric welders. Several new ranges of equipment are shown, including a sheet steel cubicle type distribution board equipped with 200 and 400 A draw-out type air break circuit-breakers and a 150 A contactor with isolators, one circuit-breaker being motor operated. Another new introduction is a 6-way flameproof distribution board for the oil and chemical industries. Various types of flameproof equipment for Group II gases are shown including push buttons, annunciator, limit switches and similar equipment. Welding equipment includes a large water cooled dual purpose seam welder, type WS7U; spot welders; and a bench unit, Type WP1, for welding plates up to 22 gauge.

Sifam Electrical Instrument Co., Ltd., Leigh Court, Higher Lincombe Road, Torquay, Devon.—**Stand P.4.**—The instrument section consists of instruments up to 4½in body diameter in round, square and rectangular cases and includes volume level indicators, dB meters, peak signal level indicators, 6in diameter switchboard instruments, contact instruments and moving coil relays. Pyrometry exhibits include panel mounting temperature indicators, edgewise indicators, multi-point edgewise indicators with switch, a low temperature measuring instrument and two needle-type pyrometers. A "Pyromaxim" is shown controlling the temperature of a muffle.

Simplex Electric Co., Ltd., Broadwell, Oldbury, Birmingham.—**Stand F.10.**—Representative items from the "Regent" range of switchgear are shown, such as busbar chambers, switch-fuses, switches, distribution boards, changeover switches, and "Monarch" fused switches made up in the form of a switchboard along with new gear. Lighting fittings designed to meet all industrial and commercial uses are exhibited. A new high bay fitting in anodised aluminium will take a 1 kW mercury discharge lamp with a fluorescent coating for use in the vertical position. The range of anti-corrosive fluorescent fittings has now been redesigned to include twin and single tube batten types with p.v.c. reflectors for 5, 4 and 2ft tubes. An extension to the contemporary screw-glass range has also been introduced and displayed in this range are the new 150/200 W g.l.s. lamp fittings along with wall bracket fittings taking standard 60/100 W lamps. A representative display of flameproof equipment includes general purpose flameproof enclosures and single and twin fluorescent fittings.

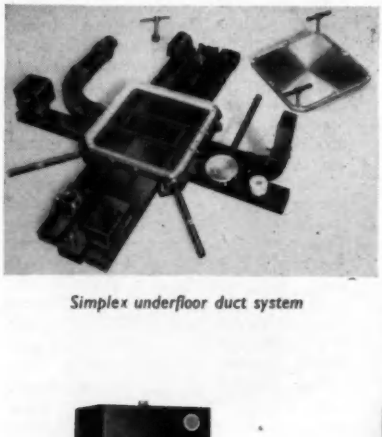
The company's new cooker control unit with a cooker switch rated up to 45 A and single rotary control is shown, together with a range of switch assemblies and switched sockets. The directly embedded floor warming system introduced by Simplex in conjunction with their associate company, Mersey Cables, Ltd., forms another part of the display, as does the company's underfloor duct system. Creda domestic appliances on show include cookers, the "Debonair" spin dryer, storage water heaters, immersion heaters and room warmers.

S.L.R. Electric, Ltd., Welbeck Road, South Harrow, Middlesex.—**Stand M.1.**—Electric light fittings and appliances including several new designs.

Small Electric Motors, Ltd., Churchfields Road, Beckenham, Kent.—**Stand J.19.**—Single-phase, three-phase and d.c. motors, including drip-proof, screen protected and types up to 10 h.p., are shown. High-speed universal motors for domestic appliances and shaded pole motors for recording machine drives are among other exhibits.

Smith Hobson, Ltd., Hersham Trading Estate, Walton-on-Thames, Surrey.—**Stand V.3.**—Miniature busbar current transformers and instrument transformers for use in aircraft.

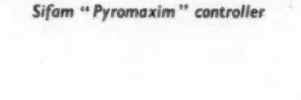
Smith Meters, Ltd., Rowan Road, Streatham Vale, London, S.W.16.—**Stand P.12.**—Among house service meters the company is showing a variable tariff prepayment meter and the "Sincos" meter for measuring kVA demand. Test sets ranging from single-phase 100 A to three-phase 2,000 A, 33 kV, can also be seen. New developments are a prepayment mechanism for attaching to television sets for the collection of hire charges; an index remotely operated by impulses from a meter installed elsewhere; and an off-peak meter, designed specially for metering the consumption taken for space heating.



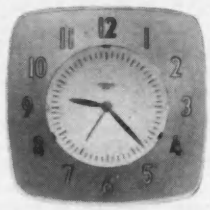
Simplex underfloor duct system

Santon lockable handle 4-position rotary switch

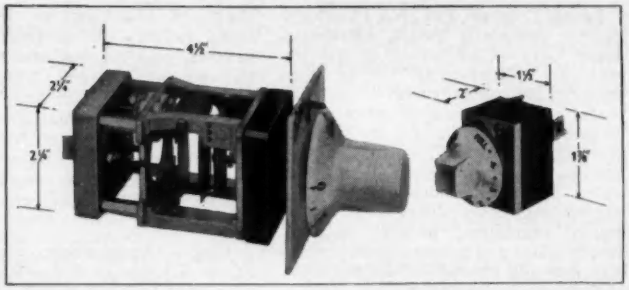
One of the latest S.L.R. Electric lighting fittings, the "Comtaire" 705



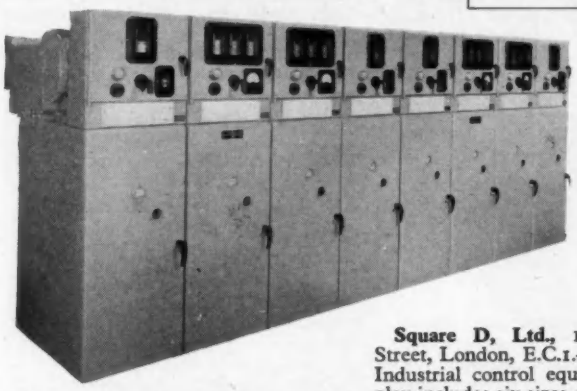
Sifam "Pyromaxim" controller



Smiths "Dubarry" "Sectric" wall clock



Sunvic Controls present-day "Simmerstat" (right) compared with the original model



Statter 8-panel 11 kV metalclad oil and compound filled switchboard

Herman Smith Smithlite, Ltd., Empire Works, Dudley, Worcs.—**Stand T.3.**—Busbar trunking complete with plug-in tap-in boxes; busbar chambers; cable trunking complete with cable taps; distribution boards; tungsten and fluorescent lighting fittings (including several new ranges) and infra-red heaters.

Smiths Clocks & Watches, Ltd., Sectric House, Waterloo Road, London, N.W.2.—**Stand E.2.**—"Sectric" clocks for the home and commercial use; and time switches for cookers, washing machines, and other domestic appliances.

South London Electrical Equipment Co., Ltd., Hither Green Lane, London, S.E.13.—**Stand X.12.**—Welding equipment and electronic timing equipment for welding machines.

South Wales Switchgear, Ltd., Blackwood, Monmouthshire.—**Stand K.7.**—The outstanding exhibit on this stand is a combined 33/11 kV outdoor air insulated metalclad substation. The rating of the 33 kV oil circuit-breaker is 1,000 MVA and that of the 11 kV o.c.b.s up to 350 MVA. Facilities are also available for the inclusion of built-in control rooms, tripping units, batteries and all auxiliary supplies. Another exhibit being shown for the first time is a non-extensible ring main unit for service at 11 kV 250 MVA. Trunking type industrial pattern switch-fusegear for 440 V service up to 400 A, and also flush fronted industrial switch-fuseboards with a 600 V insulation level fused for service at 200-400 A and incorporating contactor, distribution panels and flush fronted instruments are also on view.

Square D, Ltd., 100, Aldersgate Street, London, E.C.1.—**Stand W.5.**—Industrial control equipment on display includes six sizes of contactor and motor starters. New control accessories being shown for the first time include a range of oil-tight foot switches, 10 A machine tool relays, and plug-in limit switches.

Standard Telephones & Cables, Ltd., Connaught House, Aldwych, London, W.C.2.—**Stand E.7.**—In addition to telecommunication and power cables, capacitors, magnetic materials, quartz crystals, selenium and silicon rectifier equipments there is a display illustrating the Kariba Dam remote control scheme. A range of cores manufactured from high quality soft magnetic materials for use in equipment for computers and telecommunications and in the aircraft, marine, and radio industries; the "Stantelum" l.v. electrolytic capacitor for transistor circuits; and the new "Stantelac" miniature type capacitor using a synthetic dielectric are among the exhibits.

The company's Valve Division shows a selection of mercury and gas-filled rectifiers and water-cooled and steam-cooled triodes, and a display of Brimar valves.

J. G. Statter & Co., Ltd., 82, Victoria Street, Westminster, London, S.W.1.—**Stand M.3.**—H.v. metalclad drop-down, drawout oil circuit-breaker equipments A.S.T.A. tested and certificated up to 350 MVA 11 kV and suitable for both indoor or outdoor installation according to type are shown, in addition to metalclad automatic oil fuse-switch units with associated fault-making load-breaking non-automatic oil switch units for use on 13·2 kV systems up to 250 MVA rupturing capacity. L.v. switchgear includes h.r.c. air circuit-breakers both in fixed and horizontal drawout forms having interrupting ratings up to 31 MVA at 415 V and in sizes up to and including 3,000 A. Knife switches, isolating switches, current transformers, instrument selector switches, multi-way terminal boards, etc., are also displayed.

Sterling Cable Co., Ltd., Aldermaston, Berks.—**Stand W.1.**—Cables and accessories on display include 3- and 4-core types having simplified construction. Lightweight cables for instrumentation and new forms of jointing equipment are also shown.

Stone-Chance, Ltd., 28, St. James's Square, London, S.W.1.—**Stand Y.14.**—A special lighthouse feature will include the new optic, rotating and flashing mechanism which the company is supplying for the Eddystone lighthouse. A working model of the lighthouse and other items of historical and contemporary interest are also on view. Several new "Austinlite" products are exhibited including a cyclic switch for de-icing aircraft; automatic switchgear cubicles; and a 150 A rotary switch for heavy duty change-over applications. A "Clam-seal" underwater electric motor of the type now fitted to the range of "Sumo" submersible pumps can also be seen.

Stream-Line Filters, Ltd., Ingate Place, London, S.W.8.—**Stand X.6.**—This company specialises in the fine filtration and dehydration under vacuum, where required, of lubricating, hydraulic, transformer and switch oils and has various models covering all these applications. Those on view include one of the N3 insulating oil filters for use with X-ray equipment in hospitals.

Suntex Safety Glass Industries, Ltd., Thorney Lane, Iver, Bucks.—**Stand P.10.**—A variety of fluorescent reflectors and diffusers moulded and fabricated from "Perspex" sheet for street lighting, industrial lighting, including module fittings and other types of lighting covers for domestic, industrial and showroom use; also a selection of pressed glass light covers, including well glasses; extruded sections for fluorescent lighting troughs; and clear and coloured acrylic tubes, both cast and extruded.

Sunvic Controls, Ltd., No. 1 Factory, Eastern Industrial Estate, Harlow.—**Stand G.11.**—Comparison of the six millionth "Simmerstat" to be produced by the company with the original model introduced in 1938 indicates the progress made in design, the present production model TYX/B occupying less than one-third the space. A TQB water heater thermostat is demonstrated and other displays illustrate energy regulators, hotwire vacuum switch relays and tubes, potentiometric recorders and instruments for scientific and industrial applications.

Switchgear & Cowans, Ltd., Elsinore Road, Old Trafford, Manchester, 16.—**Stand S.12.**—Switchgear exhibits include a scale model of the K1 outdoor 33 kV 1,000 MVA oil circuit-breaker available in current ratings of 400, 800 and 1,200 A; oil circuit-breaker flush-fronted equipment, for use up to 2,400 A and 500 MVA at 6·6 kV and 11 kV; and air circuit-breakers for wall, frame or cubicle mounting in 800 and 1,600 A sizes. New mining type flameproof units include a distribution air circuit-breaker of 400 A current rating (7·5 MVA at 600 V) and a horizontally withdrawable oil circuit-breaker of 400 A (50 MVA at both 3·3 kV and 6·6 kV). Two new ring main units are also shown.

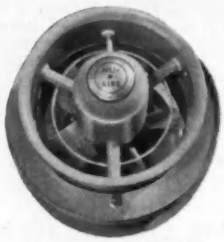
Switchgear & Equipment, Ltd., Southam Road, Banbury, Oxon.—**Stand T.7.**—Typical examples of outdoor air-break isolators and switches include rural and heavy duty types. H.v. fuses of both the liquid type and the expulsion (150 MVA tested) type are also displayed.

H. D. Symons & Co., Ltd., Park Works, Kingston Hill, Surrey.—**Stand D.11.**—Flexible varnished fabrics include cotton, silk, nylon, "Terylene" and glass types. Combination slot insulations such as "Duply," "Symax" and "Tuplex" are also on show as well as "Symite" rolled varnished fabric high-voltage sleeving and extruded silicone elastomer sleeving.

The Synchronome Co., Ltd., Woodside Place, Mount Pleasant, Alperton, Wembley, Middlesex.—**Stand K.4.**—A "Shortt" free pendulum and a standard master clock are to be seen operating on this stand. The free pendulum is typical of those installed in most observatories and holds the world's record for timekeeping. The turret clock suspended from the roof of the main hall is 6oft in diameter and is the largest clock in the world. The movement is electrically wound once an hour and is electrically released every half-minute by the master clock on the stand.

Synthetic Carbon & Engineering Co., Ltd., Cumberland Road, Stanmore, Middlesex.—**Stand F.3.**—Carbon brushes of all kinds, shapes, grades, and fittings; special metallised carbon contacts; brush holders in all forms for use on the largest or smallest commutators and sliprings; and examples of extruded, sand cast, die cast, and cartridge holders will be on show. A new range of trailing and radial holders for tandem or single brushes; and traction brush-gear will also be on the stand. Amongst the controller and contact parts exhibited are examples of controller fingers, relay assemblies, silver and sintered metal faced contacts and a very wide range of contact tips, controller drum segments, flexible connectors, braids, fuse clips, etc.

Tack Organisation, Longmoore Street, London, S.W.1.—**Stand Y.5.**—The latest addition to the "Nu-Aire" range of extractor fans is the "Nu-Aire Junior," designed for the smaller kitchen or bathroom. It is made entirely of aluminium (weight 4½ lb) and the air extraction rate is 8,500 cu ft/hr. Also new is the "Saxane Junior," an electrical appliance claimed to rid the home of flies, moths, etc.



Tack "Nu-Aire Junior" extractor fan

Right: Three designs of Tensator constant force extension springs

Tate Engineers, Ltd., Portslade, Sussex.—**Stand T.6.**—Compression equipment and various joints for steel-cored aluminium power lines include a 50 ton "Minipressor" and the 37 ton "Junior" compressor.

George E. Taylor & Co. (London), Ltd., 34, Southwark Bridge Road, London, S.E.1.—**Stand F.16.**—This company is illustrating electrical installations comprising lighting, power, bells, telephones, h.v., m.v., l.v. and control cables, instrumentation, telecommunications, etc.

Taylor Tunnicliff & Co., Ltd., Eastwood, Hanley, Stoke-on-Trent.—**Stand P.8.**—Porcelain and ceramic insulators.

Technograph Electronic Products, Ltd., 207, Fleet Road, Fleet, Aldershot, Hants.—**Stand Q.2.**—Printed circuits.

Telegraph Construction & Maintenance Co., Ltd., Mercury House, Theobald's Road, London, W.C.1.—**Stand K.12.**—The Cables Group is showing polythene insulated h.v. power cables which include a 100 kV d.c. single-core submarine type cable which has been operating under service conditions for two years. Other cables of interest are an 11 kV 3-core submarine type and 11 kV 3-core aerial types with catenary suspension strand attached and appropriate fittings. P.i. power cables for voltages up to 33 kV are also displayed as well as a comprehensive range of plastic insulated wiring cables and p.v.c. insulated armoured cables for 250 V and 660 V, and a comprehensive range of terminating glands including the F.G. flameproof series.

In addition to its super alloys—"Supermumetal," "Supermendur" and "Super Radiometal"—the Metals Group is exhibiting three types of beryllium copper compositions, CuBe 250, CuBe 50 and plastic-injection mould alloy as well as a range of thermostatic bimetals including the newly introduced brass-invar type. Magnetic & Electrical Alloys, Ltd., Telcon Magnetic Cores, Ltd., and Submarine Cables, Ltd., also have displays on this stand.

Tensator, Ltd., Acton Lane, London, N.W.10.—**Stand X.22.**—The "Tensator" constant force extension spring is one of the main exhibits on this stand. With these springs in use much longer brushes may be designed and they can operate in an ambient unventilated temperature of 200 deg C. Springs for an 80 lb studio light balance can also be seen.

V. Tessier, Ltd., 395, Staines Road, Hounslow, Middlesex.—**Stand Q.13.**—Metal formers for moving-coil instruments; examples of fine wire coil winding; printed dials for instruments; and a selection of miniature transformers for use with transistors.

Tetra Engineering Co., Ltd., 1-3, Redhill Street, London, N.W.1.—**Stand J.22.**—Mineral embedded tubular sheathed elements for domestic, industrial and commercial applications for the heating of water, chemicals, oils, metals and air with sheath temperature of up to 1,000 deg C are displayed. New finned elements for use in convection heating, infra-red drying, heating, grain and crop drying, heat exchangers and oil heating can be supplied in lengths up to 14ft in copper, mild or stainless steel and aluminium, straight or bent as required.

Texas Instruments, Ltd., Dallas Road, Bedford.—**Stand S.3.**—Silicon rectifiers, transistors and other devices. On view for the first time is the "Sensistor," a temperature compensator with a stable positive temperature coefficient of resistance, ideal for temperature compensation in transistor and similar circuits.

Thames Wire & Cable Co., Ltd., Brewery Road, Hoddesdon, Hertfordshire.—**Stand X.14.**—Reels of the company's latest product, polyester enamelled wires and strips, form the main exhibit. Literature is also available covering paper, glass, and cotton insulated wires and strips for transformer, motor and switchgear windings.

Thermalay, Ltd., Shelf Mills, Shelf, nr. Halifax, Yorkshire.—**Stand P.1.**—Electrically heated carpet underfelts and electrically heated mats.

Thermodare (Great Britain), 94-98, Petty France, London, S.W.1.—**Stand M.2.**—"Thermodare" storage heaters on display now have an improved terminal box situated on the side of the heater for easy connection. Also on show are floor heating equipment, with re-designed register and troughing to enable a better floor finish to be obtained, and infra-red heaters of high wattage for use in churches.

Fredk. Thomas & Co., Ltd., Everton Buildings, Stanhope Street, London, N.W.1.—**Stand U.6.**—Tungsten and fluorescent lighting fittings include bedhead lights, ward lights and other special hospital fittings; and classroom, gymnasium and assembly hall lights for schools. Several fittings are shown for the first time.

F. W. Thorpe, Ltd., Welby Road, Hall Green, Birmingham, 28.—**Stand J.7.**—Industrial and commercial lighting equipment for fluorescent, tungsten, mercury and sodium discharge lamps.

T.M.C. Harwell (Sales), Ltd., 37, Upper Berkeley Street, London, W.1. —**Stand C.2.**—The range of "Temco" electrical wiring accessories on show consists of wall and ceiling switches; socket outlets (switched and unswitched); plugs; junction boxes; and appliance connectors. Among new products are 13 A metalclad socket and switch socket outlets (surface and flush) and 5 A plaster-depth plate fixing switches. An enlarged working model of a new "Temco" a.c. switch action may also be seen.

Transformers (Watford), Ltd., Sandown Road, Watford, Herts.—**Stand P.5.**—A 750 kVA, 3-phase, 50 c/s, 11,000/430 V, air cooled transformer with Class "C" insulation is exhibited. Transformer on-load tap change equipment of the "Jansen" type is shown for the first time in this country. Its compact design makes it singularly adaptable for cover mounting, leaving transformer tank sides and ends clear for cooling equipments, cable boxes, etc. The tap changer exhibited is suitable for 18-step, fully automatic regulation on a 10 MVA, 33 kV, 3-phase transformer.

Tricity Cookers, Ltd., 233, Shaftesbury Avenue, London, W.C.2.—**Stand L.7.**—The company's latest cooker, the Tricity "Marquis," is shown, together with the "Viscount" and "Popular" cookers.

Troughton & Young (Lighting), Ltd., 143, Knightsbridge, London, S.W.1.—**Stand G.12.**—Tungsten and fluorescent lighting fittings include recessed, ceiling, pendant, table and floor standards. A central feature shows the "Rambusch" high intensity recessed fitting, with a photoelectric cell and measuring device below. Surrounding this is a new range of glassware comprising ceiling and pendant fittings. New wall brackets are also on show.

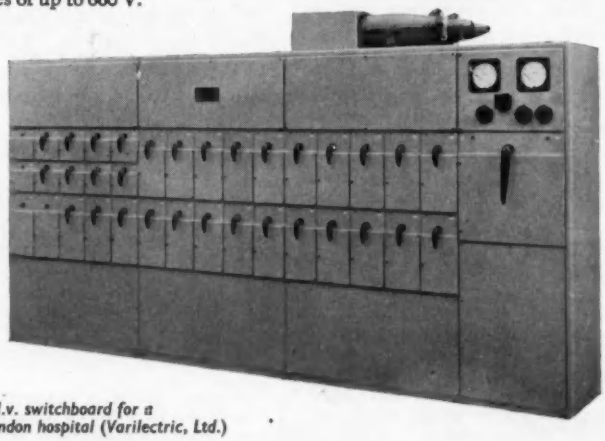
Tufnol, Ltd., Perry Barr, Birmingham, 22B.—**Stand K.15.**—A selection of electrical components made from "Tufnol" is exhibited. One example of the advantage of its dielectric and mechanical properties is the use of copper-clad sheets for producing printed circuits. Also of interest are bearing pads used extensively to support pipes in the North of Scotland hydro-electric schemes. Other components of "Tufnol" include a display of intricate punchings; a multi-way terminal board; and bell, barrel and ball moulded insulators for working voltages of up to 660 V.

Turners Asbestos Cement Co., Ltd., Trafford Park, Manchester, 17.—**Stand T.5.**—New products include melamine resin/asbestos paper laminates with non-burning, tracking resistant characteristics, and having greatly improved electric strength and insulation resistance; "Electrofine" asbestos paper with epoxy resin impregnation; and "Electrofine" asbestos paper with silicone impregnation for interleaving and bonding solid the turns of traction field coils.

Tyrad Electric, Ltd., Imperial Court, Basil Street, Knightsbridge, London, S.W.3.—**Stand G.12.**—Electric space heating equipment includes underfloor heating systems (embedded and ducted), block storage heaters, infra-red heaters, panel heaters and fan convectors. A new block storage heater is shown under test, with ten thermocouples connected to an indicating meter.

Ucan Development, Ltd., The Quadrant, Richmond, Surrey.—**Stand N.3.**—Wiring tools and accessories and new types of spacer bar saddles.

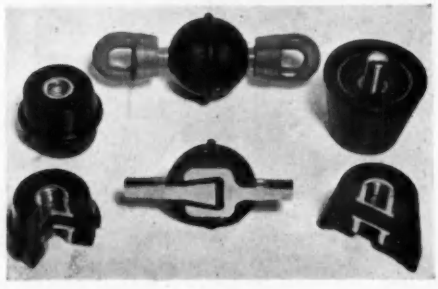
Uni-Tubes, Ltd., 1-2, Langham Place, London, W.1.—**Stand D.10.**—"Kopex" pliable electrical conduit which can be bent, set and cut by hand is composed of layers of metal and paper strips. It is produced in continuous lengths, or minimum 100ft coils, in standard electrical sizes from



A main l.v. switchboard for a large London hospital (Varilectric, Ltd.)

Gymnasium ceiling reflector with angled fixing bracket (Fredk. Thomas & Co.)

Group of "Tufnol" insulators, proof tested at 2 kV for 1 minute



½ to 3in o.d. and is also available with p.v.c. covering.

Vanguard Engineering Co., 193-201, Lee High Road, London, S.E.13.—**Stand M.7.**—Fluorescent lighting fittings for industrial, commercial and domestic use.

Varilectric, Ltd., 10, Melon Road, Peckham, London, S.E.15.—**Stand G.13.**—Cubicle and pedestal type switchboards; distribution fuseboards (both flush and surface patterns, with and without built-in isolators); rising main busbars and associated floor control equipment; miniature, rising main or overhead busbars up to 300 A 4-pole; sheet steel cable trunking; skirting ducting; an overhead busbar system; and multi-tier motor starter panels incorporating combination fused-switch/d.o.l. starter units.

Venner, Ltd., Kingston By-Pass, New Malden, Surrey.—**Stand L.1.**—A new synchronous motor driven time switch suitable for the control of domestic appliances can be supplied in either a metal or plastic case with transparent cover and can be set to obtain up to three on and off times within 24 hours. The switch, type MD1QP, has an external manual device so that the appliance can be switched on or off at any time without upsetting the dial setting.

Vent-Axia, Ltd., 60, Rochester Row, London, S.W.1.—**Stand U.5.**—A complete range of electrically driven ventilating units, including intake, extract and reversible types, together with iris shutters and other ancillary equipment, is shown in the standard black finish and also (for the first time) in ivory plastics.

Vernons Industries, Ltd., Kirkby Industrial Estate, Liverpool.—**Stand R.7.**—Included in a selection of rotating electrical machines and control gear is a 150 kW alternator, together with its exciter and control panel. A transportable power pack, a vertical a.c. motor/alternator set providing a mobile 400 c/s 200 V power supply, is only 20in in diameter and is intended for use with guided weapons, radar and laboratory equipment. Several of the company's latest two-stage transistorised automatic voltage regulators are shown for the first time.

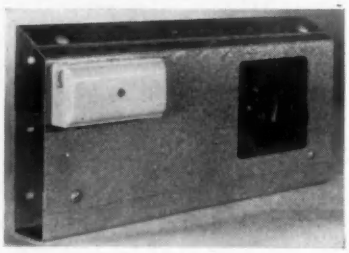
Venner type MD1QP time switch fitted to a typical domestic hot water tank

V.G. Porcelain Co., Ltd., Gorst Road, Park Royal, London, N.W.10.—**Stand F.6.**—High refractories and porcelains for the electrical and allied industries; "Scruit" connectors; porcelain and steatite insulating beads.

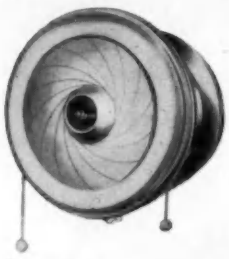
Vokes & Vokes Genspring, Ltd., Henley Park, Guildford, Surrey.—**Stand X.6.**—Vokes' exhibits consist of automatic air filters; unit filters for arranging in bank formation for large air-conditioning installations; and air intake panel filters both dry and oil wetted, "constant efficiency" and "reducing efficiency" types that are used in connection with the protection of electrical equipment in power stations, factories, etc. "Microvee" dry type panel filters for alternators, generators and electric motor applications are also on view, with "Millevee" and "Multivee" panel filters for radio and radar equipment and a new "No. 7" air filter panel of the throw-away type.

Vokes Genspring are showing "M" type constant support hangers for supporting pipes and ducting in nuclear power stations, etc. Type "M 6" is capable of supporting a load of 90,000 lb over a vertical movement of 4in travel, while another new "M" type, the "M 5," will support 15,000 lb over a vertical movement of 4in. All supports are capable of accommodating vertical travels of up to 12in with reduced loading.

W. G. Walker & Co. (Engineers), Ltd., Emery Hill Street, Westminster, London, S.W.1.—**Stand K.6.**—"Mainstay" overhead busbar trunking (with plug-in fuse boxes); cable-tap systems,



"Mainstay" type SKT/1 skirting trunking allows cable accessibility at all times and enables additional circuits to be added when desired (W. G. Walker & Co.)



Vent-Axia 7½in reversible ventilating unit shown with iris shutter in the closed position

0-600 A, d.p., t.p. and t.p. and n.; busbar chambers, 0-1,000 A; cable suspension hooks and hangers; cable racks; cable trunking systems; skirting trunking; chequer top-floor trunking; flush wall trunking; and underfloor trunking with floor boxes.

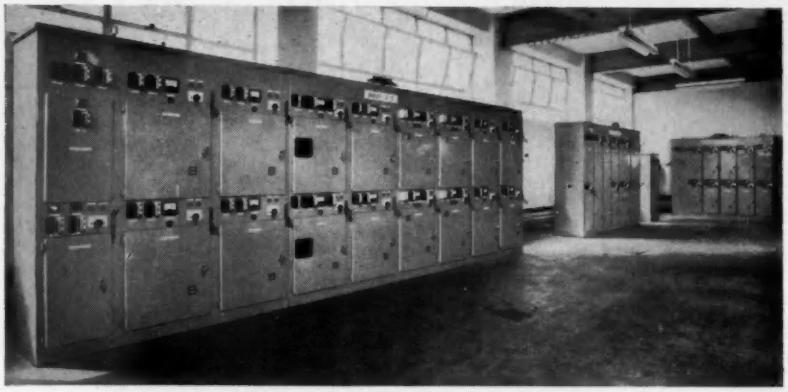
Wallacetown Engineering Co., Ltd., Viewfield Road, Ayr, Scotland.—**Stand V.6.**—Switchgear exhibits incorporate the company's latest design features including air-break circuit-breaker ratings up to 300 A in half tier cubicles. Pillar units provided with either contactors or circuit-breakers are also on view. Flame-proof equipment includes a 4-panel switchboard incorporating units complying with N.C.B. standard specifications.

Walsall Conduits, Ltd., Hilltop, West Bromwich, Staffs.—**Stand E.5.**—New products include weatherproof/flame-proof circular conduit boxes; fluorescent fittings; a range of adjustable 4-socket outlets; "off-standard" 13 A accessories; a 100 A cable tap trunking system; pedestal fuse units; and busbar chambers.

Wandleside Cable Works, Ltd., 106, Garratt Lane, Wandsworth, London, S.W.18. — **Stand K.15.** — Cables for high temperature operation specially designed for guided missiles, rocket propulsion and other heat and fire resisting applications are shown in addition to a complete range of rubber and thermoplastic insulated standard cables. There is also a selection of special cables for aircraft, power stations, railways, floor heating and soil warming, mines and quarries, radio, television and electronics.

Wandsworth Electrical Manufacturing Co., Ltd., 136, Cromwell Road, Kensington, London, S.W.7.—**Stand E.12.**—Mercury sparkless switches and switch sockets for operating theatres are among the wide range of electrical accessories to be seen. The company is also showing an extensive collection of composite units, including bedside units for hospitals, large multiple-phase units, etc., and a new range of metal plated rocker controlled switches. Besides the standard "Bunnie" electric incinerator there is a new 3 kW "Warden" machine which deals with most problems of bulk disposal.

Wardle Engineering Co., Ltd., Elsinore Works, Old Trafford, Manchester, 16.—**Stand R.2.**—Weather-proof lighting units on view include the "Prismalux," available in five designs; the "Prismalette," a detachable cover type unit available with guard; and a fluorescent bulkhead unit designed for two or three 8 W 12in tubes. Among floodlight projectors are types for 85/140 W and 300/500 W lamps, all with standard green enamel finish. Angle floodlights are also shown, as well as street lighting lanterns for both Group "A" and "B" schemes. Space heating appliances include the "Maxheat" oval tubular electric heater available for



Above : Watford multi-motor switchboards as installed in one of the latest power stations. Right : Wandsworth "Warden" 3 kW electric incinerator

wall or floor mounting in lengths from 2 to 17ft, single- or up to six-tier, 60 or 80 W/ft. The "Maxheat" convector heater in 1 or 2 kW sizes is a new product with an outer casing of wood finished in two pastel colours or veneered to harmonise with furniture. An inner steel casing minimises surface temperature.

Watford Electric & Manufacturing Co., Ltd., Victoria Street, Westminster, London, S.W.1.—**Stand L.2.**—A range of automatic air-break h.v. and l.v. starters and switchboards is shown. The 3·3 kV direct switching contactor cubicle is capable of directly connecting to the supply motors up to and including 1,000 h.p.; it has a tested make/break rating of 50 MVA and the complete unit has been tested for 150 MVA fault level. All exhibits are fitted with contactors and glass dashpot overload releases.

Watliff Co., Ltd., Lombard Road, Morden Road, South Wimbledon, London, S.W.19.—**Stand K.22.**—Commutators and slip-rings in moulded and built-up construction.

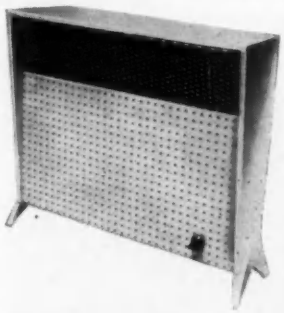
Westinghouse Brake & Signal Co., Ltd., 82, York Way, King's Cross, London, N.1.—**Stand G.10.**—A range of copper-oxide, selenium, germanium and silicon rectifiers, showing various forms of construction and means of heat dissipation, is displayed. There are also assembled rectifiers with associated components in differing types of housing to suit varying site requirements while photographic illustrations give an indication of the various loads requiring larger d.c. power supplies which can now be provided by the new semiconductor rectifiers.

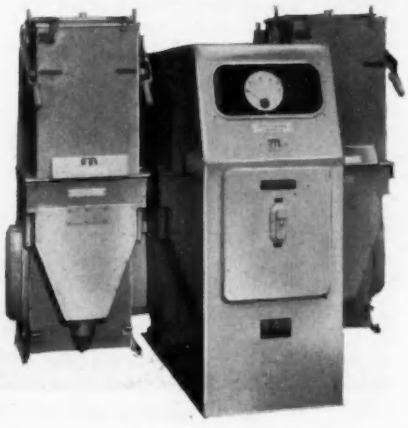
Westwood Switchgear, Ltd., 22, Gorst Road, Park Royal, London, N.W.10.—**Stand H.2.**—Unit assembly switchboards; change-over switches; and knife switches from 30 to 2,000 A.

Whipp & Bourne, Ltd., Castleton, Rochdale, Lancs.—**Stand J.26.**—A double-tier, 415 V, a.c. cubicle containing two 900 A air circuit-breakers is displayed equipped with meters, relays, etc.; also a similar but single-tier cubicle containing a 2,000 A breaker.

William White (Switchgear), Ltd., 368, Coldharbour Lane, Brixton, London, S.W.9.—**Stand F.14.**—Cubicle switchboards and rising main distribution equipment.

Edward Wilcox & Co., Ltd., Sharston Road, Wythenshawe, Manchester. — **Stand S.18.** — "Slydlok" vibration-proof fuses and ancillary equipment ranging from 5 to 100 A is shown, with examples of the "X" and "G" ranges and the later "H" range which can be seen in standard form and with the exclusive in-built neon indicator lamps. Another feature is the range of fuse cabinets incorporating "H" type fuse units suitable without change for either rewirable or h.r.c. protection. They are available in 5-15 A and 15-30 A sizes, with standard ways of 4, 6, 8, 10 and 12; the usual arrangements are offered up to t.p. and n., the latter having multi-way neutral bars to facilitate split-phase installation.





Above : Wardle Engineering Co.'s "Maxheat" convector heater. Right : Yorkshire Switchgear type IVI0-13 outdoor extensible ring main unit for 6·6/11 kV duty at fault levels of 150/250 MVA

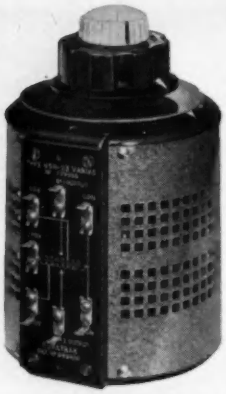
Wire Products & Machine Design, Ltd., Kingsbury Works, Bridge Road, Haywards Heath, Sussex. — **Stand G.19.**—Precision components ranging from assembled articles to simple cut wires are shown. Among new products are a miniature plug and socket connector for printed circuits; electricians' round feed through and draw wires. Recently introduced are terminal pack boxes containing assorted terminal pins.

Woden Transformer Co., Ltd., Moxley Road, Bilston, Staffs.—**Stand J.10.**—Power distribution transformers from 5 to 500 kVA in both ground-mounting and pole-mounting types are displayed in addition to a range of industrial transformers.

Yorkshire Switchgear & Engineering Co., Ltd., Leeds, 6.—**Stand G.1.**—IVIO/F metalclad distribution switchgear of both indoor and outdoor designs form the basis of this company's display. The outdoor equipments include extensible and non-extensible ring main units each with fault making/load breaking wing oil switches of the isolatable and non-isolatable pattern. "Tee-off" circuits are controlled by either isolatable

circuit-breaker or fused oil switch and the complete units are tested and certified for 6·6/11 kV duties at fault levels of up to 250 MVA. Indoor type IVIF-13 flush-fronted switchgear rated for 6·6 kV, 150/250 MVA duty and current loadings of 400 A and 1,200 A complete the exhibits.

Zenith Electric Co., Ltd., Villiers Road, Willesden Green, London, N.W.2.—**Stand Q.3.**—Among "Variac" regulating transformers on view is a 230 V 50 c/s unit providing an output variable between zero and 270 V, maximum rated current 20 A. The smaller types of "Variacs" have now been re-designed using parts from the "V5" series, enabling a more compact example to be produced. Other exhibits include rubber-glove testing equipment; motor speed control units for controlling the speed of d.c. motors from an a.c. source; earth loop testing equipment; single-phase meter testing equipment; a phase shifting transformer; an automatic voltage regulator;



Zenith type V5HM/2B "Variac" regulating transformer

flash testing equipment; tubular adjustable resistances; fixed ratio transformers; choke coils; and resistors.

Heat Treating Transformer Laminations

STRESS-RELIEF heat treatment of transformer laminations in continuous conveyor furnaces is part of the work carried out by the Heat Treatment & Brazing Co., Ltd., at Hersham, Surrey, and an additional furnace is now being manufactured for them by Royce Electric Furnaces, Ltd., Walton-on-Thames. The furnace, which is used for heat treatment cycles averaging 60 minutes in duration, operates at temperatures up to 1,050 deg C. Its average power consumption per ton of laminations is 300 kWh and some 3,000 cu ft of town gas and 370 gallons of water are required. The short time cycle gives considerable power savings and minimises carbon pick-up, a characteristic permitting the use of an inexpensive protective atmosphere derived from town gas. Laminations pass on the conveyor through a predetermined heat and cooling cycle, ensuring that all have identical treatment which can be repeated as desired.

The heating chamber is divided into independent zones controlled to close temperature limits for varying weights of charge. Heating elements of 80/20 nickel chromium are distributed over the roof and hearth of the furnace. The heaters can be controlled in independent banks to suit lamination dimensions and conveyor rate, eliminating distortion. Immediately following the heating chamber is a slow cool section leading to a water cooled zone to bring the work below oxidation temperature before discharge from the protective atmosphere. The furnace is completed by fully automatic temperature control gear and a protective atmosphere generator. Other units are being built for London Transformer Products, Ltd., and Foster Transformers, Ltd.

Conveyor furnace for stress relieving transformer laminations

Foreign Plant in the U.S.A.

Since we wrote last week on the subject of foreign tenders for electrical plant for various United States authorities, there have been further developments. We reported that a contract for two 200 MW sets had been placed with Brown Boveri & Co., Switzerland, by the Los Angeles Department of Water and Power. Some American manufacturers contended that the placing of the order abroad would endanger national security because of likely delays in carrying out repairs in wartime. The Swiss concern maintains that it has adequate service facilities in the United States and Canada.

The Tennessee Valley Authority has stated that it does not intend to hold up the contract placed with C. A. Parsons & Co. for steam turbo-generator plant, in spite of protests by manufacturers and Congressmen.

The Committee for Trade Policy has asked the Office of Civil Defense Mobilisation not to accede to the request of the American General Electric and the National Electrical Manufacturers' Association for restrictions or an embargo on the importation of certain classes of heavy electrical equipment, on the grounds of "national security." The Committee expresses its concern at the rejection of the English Electric Co.'s tender for plant for the Greer's Ferry dam (Arkansas) although it was the lowest. It says that there is no proof that the equipment offered by foreign makers is in any way inferior to the American product.

The petition of the American electrical manufacturers on the general question is still under consideration by the Office of Defense Mobilisation but in the meantime the Westinghouse Corporation has filed a request to the Office to advise the T.V.A. to retract its acceptance of the Parsons tender.

Trade Agreement with Bulgaria

Negotiations in London with representatives of the Government of Bulgaria have resulted in the signing on 27th February of a new trade arrangement and an exchange of notes concerning the financial agreement of 22nd September, 1955, under which the rate of payment of debt will be accelerated.

The trade arrangement agreed upon provides a basis for trade until 31st March, 1962, and import quotas will be negotiated annually. It allows for Bulgarian purchases during the twelve months ending 31st March, 1960, of some £5½ million worth of United Kingdom goods, including machinery, radio, television and telegraph communication equipment. It provides for the issue during the same period of import licences up to a total of some £2½ million for Bulgarian goods, including electrical equipment.

ELECTRIC FLOOR HEATING

Common Fallacies and Lessons from Experience

IN a paper entitled "Off-Peak Floor Heating" by Mr. H. H. Bruce which was read before the Institution of Heating and Ventilating Engineers last week the author considered what he described as common fallacies in the light of factual evidence. Building construction was shown to be of importance in relation to the characteristics of the heating system. Results from experience were taken into account in developing a tentative design basis.

Some of the fallacies stated by the author to be overdue for exposure included the following:—

(1) That customary off-peak schedules did not cause overheating at night.

(2) That room size, shape, exposure and partitions were of little importance compared with the thickness and weight of the outer wall.

(3) That the so-called "self-regulating" property of a warm floor prevented appreciable variation in floor surface and room temperature and was always advantageous.

(4) That a floor surface temperature of 75 deg F could provide full heating in living rooms and offices of normal construction and exposure.

(5) That the value of heat stored in the ground under a solid floor warranted the omission of horizontal ground insulation.

(6) That the outdoor temperature before 7 a.m. was a suitable index of heat requirements for the day.

Conclusions from E.R.A. Tests

The results of an E.R.A. off-peak floor heating test were considered. The test room, built inside a laboratory, was 10ft by 10ft by 7ft high with 4½in brick walls, a half-glazed door and a ceiling of 1½in timber with plaster board lining. These tests showed that an average temperature rise of 9½ deg was provided from 9 p.m. to 9 a.m. compared with only 5½ deg from 9 a.m. to 9 p.m. The paper posed the question: If the temperature rise of 5½ deg F would suffice during daytime, why provide a 9½ deg rise at night? It was difficult to believe that in such circumstances anyone would willingly use off-peak electricity at 1d/kWh in preference to a much smaller amount on normal supply at 1½d with freedom to use it intelligently. If the heating were to be carried out during the day, there would be 42 per cent less heat loss than the 73 per cent loss when using the off-peak supply. One lesson to be learned from this was that single-storey buildings without partitions, if occupied for only 50 hours each week, should have quick-response heating. Other conclusions drawn from this test were that heat storage below the slab was a complete loss during the heating season. If full or partial floor heating could be justified for this room, there should have been horizontal and vertical floor insulation at the perimeter.

Experience with floor heating in the eight-storey block of flats at Valley Gardens, Kirkcaldy, was described. In the three-apartment flat there was negligible partition storage in relation to the heat loss. The use of thermal insulation below the screed made the floor quite unsuitable for off-peak floor heating. It was suggested that the sensible way to use the so-called "off-peak" floor heating in these rooms was to switch on only during the afternoon when off-peak current was available for two or three hours and possibly for the two hours 7 p.m. to 9 p.m. It was doubtful if the floor heating in the living rooms was used sufficiently to justify the cost of installation.

With floor heating, the heat source was only a few degrees above room temperature, so a small change in this difference affected the rate of heat transmission quite appreciably. The euphemism "self-regulating property" meant that, if room temperature fell by one degree, the heat emission from the floor would increase. The E.R.A. tests showed that as soon as the current was switched off room temperature fell at a rate depending on indoor/outdoor temperature difference, and the floor temperature fell at a rate depending on floor surface minus indoor temperature, the rate falling as the temperatures converged.

Floor thermostats should be installed wherever carpets were likely to be placed and more conservative loadings and/or a change of method were indicated. Carpets had caused difficulties with floor finishes and rubber underlays; thermoplastic tiles had taken up the impression of the carpet; and underfelt and wood-block floors had suffered excessive shrinkage.

Experience with an office block was discussed by the author. Excessive air change was blamed for the failure of off-peak floor heating in this instance and there were several complaints of "tired feet." But the author contended that the plea of excessive air change was unrealistic.

A suggested design basis for commercial buildings was given in the paper. One of the conditions was that the indoor temperature during hours of occupation should be held within ±2 deg of the specified temperature. The floor surface temperature should not exceed 80 deg F at any time and precautions against excessive floor temperatures under carpets should be specified.

Changes of outdoor temperature and wind direction followed a well-defined pattern, but departures from normal happened with significant frequency and had to be taken into account. A suggested method of control of the off-peak system was that during the night the system should replace the heat lost during the previous day and that the indoor temperature should be restored to 68 deg F by 7 a.m., preferably not much earlier. Indoor temperature rather than outdoor temperature then became the dominant factor in the design of the control system. There must, however, be some regard for outdoor temperature.

DISCUSSION

Mr. J. W. Moule said that from the wealth of highly successful experience available it was clear that, despite what Mr. Bruce had said, electrical floor warming had taken its place as the pattern of the future. Mr. Bruce appeared to ignore the considerable work that had been carried out in the past ten years and most of the fallacies to which he had referred had already been dealt with in a paper two years ago to another Institution. The position as to the Kirkcaldy flats had, he thought, been misrepresented and he read extracts from a letter from the borough surveyor of Kirkcaldy to this effect.

Mr. J. B. Dick said he had no definite views on off-peak electrical floor heating, but he agreed with Mr. Bruce that there was a real need for more facts on performance.

A study was being made of the performance of all types of heating systems in flats from central heating to off-peak electrical heating and open fires, including the Kirkcaldy, Reading and Pilton flats, covering fuel consumption, temperature obtained for money spent, tenants' satisfaction and capital costs. All this information was essential if the merits of different systems were to be compared. One point that might be considered was the possibility of a lower air change rate in the light of the I.E.E. recommendations and the practice now established in the electrical industry whereby with off-peak heating plus a midday boost an allowance of perhaps 30 per cent only was made on a steady-state rating.

Miss M. V. Griffiths said it must be agreed that certain installations would have been improved had notice been taken of the conclusions of the E.R.A. Report Y/T11, but no mention was made in the paper of the numerous successful installations. In office buildings, the use of a time temperature controller, as developed since 1947, could postpone the supply of energy until, say, midnight, and this would appear to be an intelligent use of off-peak electricity.

Mr. L. C. Smith said that Mr. Bruce's analysis of electrical floor heating systems already installed had definitely shown that this method of heating was in its youth—he had almost said infancy. The ambiguous statements made in the earlier days had no doubt led heating engineers to refrain from over-enthusiasm. This applied particularly to the calculation of electrical loading. Some of the main steps in design were clarified in the paper and it was to be hoped that research and development in off-peak electrical heating would provide the heating engineer with further sound principles of design and application.

Mr. L. Shepherd said the electricity supply industry must not be held wholly responsible for the over-enthusiasm and perhaps over-keen competition that had led to extravagant claims for off-peak floor heating. It had arisen largely from a desire on the part of some exponents to over-simplify design technique. What he hoped was a logical design technique had now been developed on the basis of conventional heat-loss calculations as set forth by the Institution. Might he suggest that the supply industry had gathered a lot of "know how" to which Mr. Bruce had not had access?

Mr. E. M. Ackery said the electricity supply industry welcomed Mr. Bruce's acknowledgment of the general benefit to be obtained from the improvement of the load factor, and his acceptance of electrical heating as a useful addition to the means of dealing with space-heating problems. They also welcomed his condemnation of the opposition undoubtedly shown in the past by the heating engineer. What the industry wanted was not necessarily electrical floor warming but off-peak heating. It seemed to him that Mr. Bruce was expecting from electrical floor warming a degree of perfection that was not found in other systems.

Mr. S. A. Williams said that the electricity authorities had been studying means of building up night load for a long time. With the advent of nuclear power stations which could not be shut down at night it was important to find some outlet for the electricity, and the heating of buildings was an obvious solution. Whether they liked it or not, off-peak heating would be more and more a problem in the heating engineers' lives.

Dr. F. M. H. Taylor suggested that representatives of the electrical industry would do better to give positive figures of temperatures obtained and costs, including an allowance for capital costs, than to quote tenants who were satisfied with the results. In public authority housing, in particular, there could be an element of subsidy which masked the real results. On the other hand, full and frank disclosure of facts would secure the goodwill and interest of members of the Institution as well as their active help. Their aim was to get the right form of heating into the right place.

Mr. D. S. Lewis pointed out that it was quite wrong to say heating engineers were against electric heating: it was they, more or less, who had introduced off-peak heating into this country.

E.R.A. REPORTS

Effects of Irradiating Polythene. — In report Ref. L/T377 "Effects of Irradiation on the Dielectric Properties of Polythene" by E. Rushton (price 10s 6d) the effects of neutron and electron irradiation on polythene have been investigated. Samples of ordinary polythene, prepared at relatively high temperatures and pressures, and the new high-density polythenes prepared at relatively low temperatures and pressures, have been examined. Irradiation dosages up to about 10 megarads have little effect on the dielectric properties of ordinary polythene, but dosages of greater amount cause increases in loss tangent, and the larger the dosage the greater the increase in loss tangent.

The effect of irradiation on the dielectric properties is very similar to that produced by milling at high temperature—140 deg C—in air and this, together with the finding that polythene containing anti-oxidant is much less affected by irradiation than polythene with no anti-oxidant, suggests that the observed effects on polythene without anti-oxidant are probably to be explained by oxidation. Very thin films of material show no greater effects from irradiation than relatively thick samples, so the observed effect of radiation is not predominantly a surface effect. Two examples of high-density polythene were examined. One has exceptionally low dielectric losses in the untreated state, but the losses are increased on irradiation. The other shows appreciably greater dielectric losses in the untreated state, and it must be presumed that these losses are mainly determined not by the polythene structure but by impurities, possibly unremoved catalyst. This work was carried out at the National Physical Laboratory.

Radiation Losses from High Current Arcs.—Existing theoretical work on the radiation from high current arcs is summarised, and in parts amplified, in report Ref. G/XT164 "Radiation Losses from Gases in the Electric Arc" by H. Pelzer (price 15s). Some of the earlier results are found to be in error and are corrected. An estimate is obtained of the total energy loss due to radiation in the temperature range from 10,000 deg to 35,000 deg K. It is in fair agreement with observation, and amounts to about one-quarter of the loss due to conduction discussed in an earlier report, Ref. G/XT155.

Copies of these reports are available, at the prices indicated, from the publications sales department of the Association at Thorncroft Manor, Dorking Road, Leatherhead, Surrey.

INDUSTRIAL NEWS

Modern Cooking Promotional Committee

With the object of stressing the advantages of cooking by electricity and highlighting the improvements continually being incorporated in new cookers, nine leading manufacturers of domestic electric cookers have formed a committee and will shortly be starting a large scale promotion drive to increase cooker sales. The manufacturers who will be concerned in what will be known as the Modern Cooking Promotional Committee are—Allied Ironfounders, Ltd., Belling & Co., Ltd., Carron Company, the English Electric Co., Ltd., the General Electric Co., Ltd., the Electrical Division of Radiation, Ltd., the Revo Electric Co., Ltd., the Simplex Electric Co., Ltd., and Tricity Cookers, Ltd. The campaign will be aimed at all sections of the public and particular attention will be paid to domestic science teachers and couples about to be married.

Radar for Jordan

Marconi's Wireless Telegraph Co., Ltd., has obtained a contract from the Government of Jordan for the supply and installation of a new long-range early warning radar station of the latest high power type, equipped with height finding facilities and means of interception control. Associated with this are communications networks and automatic direction finding equipment. Concurrent with the project, members of the Royal Jordanian Air Force will be trained at the Marconi College at Chelmsford.

Eastern Region Locomotives

The type 2 diesel-electric locomotive shown leaving the Loughborough works of the Brush Electrical Engineering Co., Ltd., is the first of a repeat contract for sixty to be delivered to the Eastern Region of British Railways for both freight and passenger duties. Twenty similar Brush locomotives are already in service with this region, and the latest units will ultimately be delivered at the rate of two per week. Each is fitted with a 1,365 h.p. engine, and speeds up to 90 m.p.h. will be obtained.

Type 2 diesel-electric locomotive for British Railways

Panelec Integration with B.I.C.C.

Panelec (Great Britain), Ltd., announces that owing to the increased demand for its floor warming systems and heating equipment, it has been decided that its activities will be integrated with those of the parent company, British Insulated Callender's Cables, Ltd., on 30th March, from which date it will operate as the Heating Division of B.I.C.C. and will assume full responsibility for the supply, sales and associated technical services for all heating systems, heating cables, etc., produced by the company. "Panelec" will be retained as the trade name for the products of the division and the headquarters will continue to operate from 21, Bloomsbury Street, London, W.C.1. The existing technical advisory and sales services will in future be available through the branch offices of the parent company.

Winding Engine Contracts

Contracts totalling nearly £250,000 for two large mine winding engines and related equipment have been received by the General Electric Co., Ltd., from the National Coal Board. The plant will serve the upcast and downcast shafts at the Duffryn Rhondda Colliery in the South-Western Division. Each equipment will have two 17ft diameter by 5ft 5in wide drums, driven through single reduction gears by a 3,300 V 2,400 h.p. a.c. motor running at 356 r.p.m. To permit winding from several mine levels, one drum will be fitted with a multiple-tooth clutch. The mechanical brakes will be of the high pressure (3,500/5,000 p.s.i.) oil-operated type. At the upcast shaft, where the cage will carry coal, stone, and men, the winding engine will be capable of raising 186 tons of coal an hour from a depth of 2,370ft although the equipment is designed for winding from 2,700ft. Control of the winder motor will be through an air-break stator reversing contactor and a liquid controller, while the control scheme will include the company's latest design of dynamic braking. At the downcast shaft the winding engine will be of similar design but arranged for the balanced skip-winding of coal. Each skip will have a capacity of 7½ tons, and the equipment is designed for an output of 240 tons an hour from 2,370ft. This equipment is also designed for future operation from 2,700ft. The control scheme for the a.c. driving motor will also be similar, except that the company's patented closed-loop control system will be incorporated.

Pumping Machinery Order

The contract for machinery and equipment for two pumping stations, valued at £298,309, for the latest extension to the Liverpool Corporation's waterworks, has been awarded to W. H. Allen, Sons & Co., Ltd., Bedford. The extension is the River Dee supply portion of the Tryweryn scheme. Five 10 million gallons per day and two 5 million gallons per day Allen vertically-suspended type pumps are to be supplied for the river intake station, and the same number of Allen two-stage type pumps of similar capacity, but designed for a higher total head, will be installed in the high-lift pumping station. In addition, the contract includes the installation of associated constant and variable-speed motors, h.v. and l.v. switchgear, transformers, cabling, pipe-work and valves.

AE.I.-Gala African Campaign

A.E.I.-Gala, Ltd., the recently-formed export associate of A.E.I.-Hotpoint, Ltd., is about to begin a campaign in the Federation of Rhodesia and Nyasaland, Ghana and Nigeria. Previews are being held at Salisbury (Rhodesia), Accra (Ghana) and Lagos (Nigeria) of Gala refrigerators, washing machines, "Hi-Speed" kettles and other small appliances. Special display and point-of-sale material and leaflets are being produced for all appliances. Additionally, a colour advertising film on Gala washing machines and refrigerators will be shown in leading cinemas during the campaign.

Wireless and Electrical Trader Year Book

The 1959 edition of the *Wireless & Electrical Trader* Year Book is now available. It includes condensed specifications of nearly 250 current commercial television receivers and information on valve and cathode ray tube base connections, with over 300 valve base diagrams.

New features are an index of new products which have appeared in the *Wireless & Electrical Trader* and an index of gramophone records. Complete information is given on wages,

covering radio and television service engineers and apprentices, together with wage rates of radio and television shop managers and assistants.

There is a considerable quantity of data on radio receivers, a B.B.C. and I.T.A. station guide, legal and licensing information and a directory of trade associations.

The Buyers' Guide is in two sections, one covering domestic electrical appliances, the other general radio and electrical goods. For ease of reference, the Year Book is divided into sections printed on distinctively coloured paper, with thumb index.

The Year Book is obtainable from the Trader Publishing Co., Ltd., Dorset House, Stamford Street, London, S.E.1, at 12s 6d (postage 1s), with a reduction to subscribers to the *Wireless & Electrical Trader*.

British Display in Lisbon

At the request of British Overseas Fairs, Ltd., the Board of Trade will stage a display of British consumer goods at the British Trade Fair to be held in Lisbon from 29th May to 14th June. With the help of the Council of Industrial Design, over 300 exhibits have been selected for their suitability to the Portuguese market. They include domestic equipment, kitchen equipment, lighting fittings, radio and television sets.

Premiums for Technical Writing

The Radio Industry Council announces the award of six premiums of 25 guineas each for articles on radio and electronics published in the technical Press during 1958. The presentation of awards will be made at a luncheon on 15th April by the new director of the R.I.C., Air Marshal Sir Raymund G. Hart, with Mr. W. M. York, chairman of the public relations committee, presiding.

Mobile Display Unit

Bylock Electric, Ltd., has put into service a mobile display unit. Co-operating with wholesalers in a sales promotion drive, arrangements are made for the display unit to visit dealers accompanied by the wholesaler's representative. The unit carries a complete range of the company's products for demonstration, and incorporates a small office. In the accompanying picture the unit is seen at Bournemouth.

Bylock Electric mobile display unit at Bournemouth

Calculator on Nuclear Work

The Central Electricity Generating Board has placed an order with International Computers & Tabulators, Ltd., to rent an I.C.T. type 555 electronic calculator. It will be used for stores and cost accounting, mathematical applications and nuclear fuel element calculations, and will be installed in the London headquarters of the Board.

Strikes at Hunterston

Serious delays in the construction of the reactor and steam-raising units at Hunterston (Ayrshire) nuclear power station have been caused by unofficial strikes. Addressing the company's employees on Monday, Mr. A. R. Miller, chairman of the Motherwell Bridge & Engineering Co., a member of the G.E.C.–Simon-Carves consortium which is erecting the station, said that unless there was a marked improvement in the situation the company would ask to be relieved of its contract. Mr. Miller said that in the last seven months there had been fifteen unofficial strikes and over 55,000 man-hours had been lost.

He also complained that there was an inordinate amount of sub-standard welding which had to be cut out and made good. An official of the Boilermakers' Society, the union principally concerned, said that the work demanded a high standard from the welders and the payment of piecework rates did not encourage it.

E.D.A. Public Speaking Competition

The final stages of the Yorkshire Area of the E.D.A. Public Speaking Competition were held at the offices of the Central Electricity Generating Board, 1, Whitehall Road, Leeds, 1, on 24th and 25th February, Mr. A. Haselhurst, the Board's chief commercial officer, presiding. The first day was devoted to the women's section, the judges being Mrs. C. Renton-Taylor, member of the Board, Miss F. H. Martin, a senior science lecturer, Dr. H. V. Wiseman, lecturer in government at Leeds University, and Professor G. E. T. Mayfield, head of the Adult Education Department, Hull University. The winner was Miss Audrey Hunt, a service centre assistant in the Hull District, who spoke on "Lighting as a Public Amenity," and the second prize was won by Miss Mary Nicholas Townsend, a demonstrator in the Leeds District, whose subject was "Making the Money Go Further."

In the men's section, on the second day, the judges were Mrs. C. Renton-Taylor, Mr. W. W. Martin, deputy city treasurer of Leeds, Mr. J. R. Griffith, of the Department of Adult Education, Leeds University, and Mr. J. D. Nicholson, member and chief engineer of the Yorkshire Electricity Board. The winner was Mr. M. Moorhouse, a commercial assistant in the Halifax District, whose talk was entitled "A Place in the Sun," and the second prize was awarded to Mr. A. R. Davies, deputy station superintendent, Mexborough power station, who spoke on "Our Ideal Homes." The prizes were presented by Mrs. C. Renton-Taylor.

Southern Areas Subsidiary Companies Merge

The Southern Areas Electric Corporation announces that two of its subsidiaries have been merged. In effect, Tyer & Co., Ltd. (railway signalling equipment) takes over P.A.M., Ltd. (precision engineering and electronic equipment). Financially, P.A.M., Ltd., is taken over completely by Tyer; the board of Tyer now assumes all the responsibilities of the now defunct P.A.M., Ltd. Under the new arrangements, new projects and an increase of employment by up to 25 per cent are planned at the Guildford factory.

Pressed Steel Co.'s Plans

At Swansea last week the President of the Board of Trade laid the foundation stone of a new factory which is being erected by the Pressed Steel Co. Mr. M. A. H. Bellhouse, deputy chairman of the company, said during the proceedings that the works would initially be devoted to the production of refrigerators. Later it was proposed to extend manufacture to other household equipment, some of which would be made under licence from the company's associates, the Whirlpool Corporation, one of the largest producers of laundry equipment in America.

Nickel Bulletin

The abstracts contained in the latest issue of the *Nickel Bulletin*, published by the Mond Nickel Co., Ltd., Thames House, Millbank, London, S.W.1, cover the electrodeposition of black nickel, tin nickel and hard carbide/nickel coatings. The section dealing with non-ferrous alloys includes summaries of papers on their physical and magnetic properties and further abstracts relate to the erosion and corrosion resistances of materials to steam generated by nuclear power.

Severn Tunnel Pumping Plant

The British Transport Commission has awarded a contract to Hayward Tyler & Co., Ltd., a member of Stone-Platt Industries, Ltd., for the removal of the original beam engine pumps supplied in 1886 and installed at the

The new A.E.I. experimental xenon discharge lamp installed by Trinity House at Dungeness Lighthouse

Suibrook and Sea Wall pumping stations of the Severn Tunnel and for their replacement by high voltage Electromersible pumps. The units concerned include ten 250 h.p. and two 200 h.p. motors operating on 3,300 V and two 60 h.p. motors operating on 415 V. The contract will take over two years to complete due to the necessity of keeping the tunnel free of water during the conversion.

Television Convention

The convention being arranged by the British Institution of Radio Engineers on television engineering in science, industry and broadcasting is attracting great international interest, and many members and other delegates from overseas have arranged to attend. The convention will be held in the University of Cambridge from 1st to 5th July next and delegates will reside in the colleges of the university. Among the distinguished engineers from abroad who will participate are Dr. Vladimir K. Zworykin (director of the Medical Electronics Centre, Rockefeller Institute, New York), who will give the 4th Clerk Maxwell Memorial Lecture, and Dr. S. K. Mitra, F.R.S. (Emeritus Professor of Physics, Calcutta University).

New Light at Dungeness

Recently the main revolving navigation light at Dungeness High Lighthouse was replaced by a non-revolving flashing light of similar intensity and characteristics but whiter colour. Trinity House Research and Development Section has a field trial station at Dungeness and it decided to install a xenon lamp and equipment in the lighthouse nearby. The light is a "Mazda" 2 kW high pressure xenon discharge lamp of a type developed by the A.E.I. Lamp & Lighting Co., Ltd., for use with B.T.H. cinema projectors. It has been housed inside a small lens on the roof of the lighthouse and is operated by experimental control equipment made by Trinity House Research and Development Section. The principal advantage of the new equipment is the substantial reduction in size and complexity of the optical arrangement and in addition a reduction of the power required to operate the light. A small non-revolving lens is used with the new lamp because the light source is small but intense and may be flashed on and off instantaneously at a power of 2 kW at the correct intervals. The electricity supply to the equipment is by batteries which may be trickle charged from the mains or, in isolated or off-shore lighthouses, by small diesel generators. The new experimental light is expected to have a power of between 750,000 and 1 million candles and it is expected that a combination of circuit modification and lamp and lens design improvements will later yield as much as 5 million candle power. The lamp will be shown on the A.E.I. stand at the Electrical Engineers' Exhibition at Earls Court. It is a little over 12in long and weighs just under 2 lb.

Price Reductions

Lancashire Dynamo Electronic Products, Ltd., Rugeley, Staffs., announces substantial price reductions in their new T.L.C. transistorised level control equipment.

British Resin Products, Ltd., announces that the price of "Rigidex" high density polyethylene has been reduced by between 2d and 3d per lb depending on quantity and colour. In addition a price schedule has been introduced for standard black. Details of the price changes are available from the company, Devonshire House, Piccadilly, London, W.1.

Standard Telephones & Cables, Ltd., announces substantial reductions in the price of "Brimar" cathode ray tubes, with effect from 9th March.

Lamp Prices Revised

The General Electric Co., Ltd., announces reduced prices for "Osram" low voltage general lighting service lamps in 110 and 120 V ratings, 40-500 W, effective from 9th March. The prices of 100 and 130 V lamps are being increased from the same date. As a result of these changes, 110 and 120 V prices are now the same as those of standard 200/250 V single coil g.l.s. lamps of the same wattage.

Atlas Lighting, Ltd., also announces adjustments in the list prices of Atlas 100 to 130 V g.l.s. lamps with effect from 9th March.

Ekco-Ensign Electric, Ltd., has announced adjustments to the list prices of its 100 to 130 V g.l.s. lamps with effect from 9th March.

Automobile Lamp Discounts

Atlas Lighting, Ltd., and Ekco Ensign Electric, Ltd., announce that a scale of quantity discounts is now available on purchases of automobile, bus and cycle dynamo lamps.

South Wales Switchgear Apprentices

From Mr. A. J. Nicholas, the managing director of South Wales Switchgear, Ltd., we have received a copy of a 60-page booklet containing the names (over 700) of the company's past and present apprentices. At the moment there are about 300 of them with the company; the annual intake is of the order of 70. In a foreword, Mr. Nicholas stresses the value of the company's training scheme to the industry and the country as well as to the apprentices themselves.

Twenty Years' Metal Prices

We have received from Vivian, Younger & Bond, Ltd., Princes House, 95, Gresham Street, London, E.C.2, a copy of their latest chart of prices of copper, lead, zinc and tin for the past twenty years—1939-48.

Electroflo Service Training School

The Electroflo Meters Co., Ltd., opened its training school in October, 1958. Since then eighteen mechanics have attended two-week courses. Representatives have been accommodated from Fisons, Ltd., Winthrop Laboratories, Ltd., A. E. Reed, Ltd., and the Central Electricity Generating Board. Enrolments for 1959 are on an increasing scale. Six courses have been planned during the first six months of the year.

Advertisement Correction

In the advertisement of Kenwell Electric, Ltd., in this issue (page 155) the washing machine prices are incorrectly given. These should be: heater model, £67 16s; non-heater model, £58 7s 6d.

Trade Announcement

A new two-storey factory built by the **Firth Co., Ltd.**, Warrington, to replace an old mill destroyed by fire in 1957, is now ready for occupation. With its wide unobstructed span and modern construction it will allow the company to increase production of its existing range of wire products, and to enter new markets.

GENERATION and DEVELOPMENT

South of Scotland Board's Report

The report for 1958 of the South of Scotland Electricity Board, published this week, records a 7·7 per cent increase in sales, which totalled 5,990 million kWh. Consumers connected at 31st December last numbered 1,321,000, 25,000 more than a year ago. Further progress was made with the extension of off-peak supplies and all-electric flats with floor-warming installations now number 909, with another 2,000 under construction.

Capital expenditure during the year amounted to £27·6 million, of which £17 million was in respect of the new generating stations at Hunterston and Kincardine; the first 120 MW set at the latter station was commissioned in December. Average thermal efficiency of the Board's generating stations last year was 26·07 per cent against 24·74 per cent in 1955, when the Board was set up.

The Board's total revenue in 1958 was £37·3 million, the net result being a surplus of £67,901. A fuller summary of the report and accounts will be published in next week's issue.

Further Tariff Changes

Following the revision of bulk supply charges for 1959-60, two further Electricity Boards—North Western and South Wales—have announced changes in tariffs. The general effect is to encourage the use of electricity over longer periods, with wider adoption of heat storage methods.

With effect from the end of this month there will be an increase in the fixed charges under the North Western Board's maximum demand tariffs, accompanied by a reduction in some of the running charges, and a lower fuel cost variation. The result will be that consumers working one shift or the equivalent will generally pay somewhat more than at present; there will be little change in the case of those on two-shift operation; and those working three shifts or with long-hour use will pay less.

Changes in the Board's off-peak tariffs consist of a reduction from 0·825d to 0·75d per kWh where there is no midday supply and from 0·875d to 0·8d where a midday boost is provided.

For the time being the small rebate of 0·01d per kWh on all tariffs other than those mentioned will be continued, though this may have to be withdrawn if there is any increase in costs outside the Board's control.

From 1st April the South Wales Board is modifying its industrial maximum demand tariffs so that consumers with high load factors will benefit. The remaining consumers on these tariffs will continue to pay on the present basis for the time being, the Board stating that it is not thought appropriate at this stage that any industrial consumers should pay more for their electricity.

Other consumers, e.g. domestic and commercial, have load factors which on the average are low and this will necessitate some increases in due course. When proposals for amending the charges are put forward—probably towards the end of the year—the new industrial maximum demand tariffs now announced will be applied to all industrial consumers.

A new off-peak tariff is also being introduced, details of which will be published later.

C.E.G.B. Contracts

The Central Electricity Generating Board has placed contracts during the past two months for power stations, transmission lines and transforming stations amounting in the aggregate to approximately £14,113,000. They include the following:—

Northfleet power station: Two 12·5 MVA station transformers.—Crompton Parkinson.

Richborough: Two 120 MW reheat boilers.—John Thompson Water Tube Boilers.

West Thurrock: Building and civil engineering work for the transmission substation.—J. Gerrard & Sons.

Aberthaw: Cables and accessories.—Crompton Parkinson. Railway track work.—T. Ward & Co.

Rugeley: Cooling tower No. 3.—J. L. Kier & Co. (London).

Uskmouth "B": 415 V auxiliary switchgear.—Watford Electrical & Manufacturing Co.

Acton Lane: 66 kV switchgear.—Metropolitan-Vickers Electrical Co.

Ffestiniog: Turbine draft tube and relief valve bulkhead; storage pump intake gates and screens and gantry crane.—Sir William Arrol & Co. Penstocks.—Sulzer Bros. (London). Power station construction.—Sir Alfred McAlpine & Son.

Blyth "B": Booster pumps and boiler feed pumps.—Sulzer Bros. (London).

Skelton Grange "B": Four 3,800,000 g.p.h. natural draught cooling towers.—Mitchell Construction Co.

Thorpe Marsh: Two 90 ton overhead electric travelling cranes.—Babcock & Wilcox. Booster and starting and standby boiler feed pumps.—G. & J. Weir. Preliminary works.—Mitchell Construction Co.

Northfleet West substation: 132 kV cables and auxiliary cables.—Pirelli-General Cable Works.

Iver substation: 275 kV switchgear.—A. Reyrolle & Co.

Hinkley Point substation: Site works.—Taylor Woodrow Construction.

Basildon-Shenfield: 132 kV overhead line.—Pirelli-General Cable Works.

Thames crossing at West Thurrock: Foundation works.—Holloway Bros. and Mears Bros. (Contractors).

Kirkstall substation: One 60 MVA, 132/33 kV transformer.—Ferranti.

Skelton Grange-Beeston Royds substation: 132 kV cables and auxiliary and pilot cables.—British Insulated Callender's Cables.

West Thurrock-Northfleet and Elstree-Tilbury: 275 kV and 132 kV overhead lines.—W. T. Henley's Telegraph Works Co.

Northfleet-Canterbury: 275 kV overhead line (part).—British Insulated Callender's Construction Co.

Belfast Housing Policy

A report comparing the merits of gas, oil and electricity for heating multi-storey buildings is to be submitted to the Belfast Corporation Housing Committee. At the last meeting of the Committee it was stated that a deputation which visited Edinburgh, Glasgow and Kirkcaldy to investigate all-electric flats built there had found that the tenants were well satisfied; annual running costs had decreased and there was much less work to do to keep the flats clean. In Glasgow the weekly all-in cost varied between 13s and 15s. Electricity in Belfast was dearer than in Scotland, however. The deputation pointed out that the Corporation was already committed to an all-electric scheme for flats and maisonnettes at Annadale. It was to the future that they must look, for when electricity became more widely used and atomic power stations were erected a reduction in charges was possible.

Thames 275 kV Crossing

When a double circuit 132 kV transmission line was carried across the River Thames at Dagenham in 1932 the 487ft transmission towers used for the crossing were the tallest in Great Britain. The Board's consulting engineers for that work were Messrs. Merz & McLellan and the installation of the crossing, which has a span length of 3,060ft, was carried out by the former Callender's Cable & Construction Co., Ltd.

The Central Electricity Generating Board has now awarded to British Insulated Callender's Construction Co., Ltd., a member of the B.I.C.C. Group, a contract for the supply and installation of another overhead crossing of the River Thames; this will be about eight miles down stream from the existing crossing. The new crossing is designed for a working voltage of 380 kV but will operate initially at 275 kV. This scheme will form

Artist's impression of 275 kV overhead line crossing at West Thurrock

part of the British supergrid system and the crossing, at West Thurrock, will enable a connection to be made to the Channel coast.

The crossing will consist of two three-phase circuits and a single earth wire. The conductors, which will be the largest ever used on an overhead transmission line forming part of the British supergrid, will be manufactured in the Prescot Works of British Insulated Callender's Cables, Ltd. They will each consist of 108 strands of 0·15in diameter aluminium wire laid over a core of 91 strands of 0·123in diameter steel wire. The overall diameter will be slightly over 2¼in, the cross-sectional area will be equivalent to 1·167 sq in of copper and the total weight of the six conductors and one earth wire will be approximately 153 tons. The continuous carrying capacity of each conductor will be 1,550 A. The crossing will have the traditional arrangement of two suspension towers and two anchor towers. The minimum clearance of the conductors above high water will be 250ft. The lattice steel suspension towers will be 630ft high and the span between them will be 4,500ft. The towers will be designed by Blaw Knox, Ltd.

Contracts Placed for Highland Hydro-Electric Project

The North of Scotland Hydro-Electric Board has placed the main civil engineering contracts for the Strathfarrar and Kilmorack scheme, which will produce 268 million kWh annually from a catchment area of 350 square miles in the counties of Inverness and Ross and Cromarty. The published cost of the scheme was £14 million and the value of the contracts placed is a considerable proportion of this sum.

The main dam will be at Loch Monar in Strathfarrar and there will be a subsidiary dam across a saddle to the west of this dam. Water from Loch Monar will pass through a tunnel 5¾ miles long to a power station near Deanie at the west end of Loch Beannachran. Below the outlet of Loch Beannachran there will be a second dam from which water will pass through a tunnel 3½ miles long to a power station on the River Farrar at the Culligran Falls. There will also be two dams and two power stations on the River Beauly. The upper dam and power station will be near the Crask of Aigas and the lower dam and power station at Kilmorack.

The Mitchell Construction Co., Ltd., has been awarded the contracts for the construction of the Monar dams, the Deanie tunnel and the Culligran tunnel and power station. Duncan Logan (Contractors), Ltd., Dingwall, are to construct the Beannachran dam and the Misgeach aqueducts; A. A. Stuart & Sons (Glasgow), Ltd., will construct the dams at Aigas and Kilmorack and the power stations which are integral parts of these structures; and Riley & Neate, Ltd., have been awarded a contract for the erection of the 132 kV transmission line which will carry the output of the power stations to the Highland grid near Beauly.

The construction of these works is expected to start soon. The civil engineering consultants are Sir William Halcrow & Partners; the electrical and mechanical consultants are Messrs. Kennedy & Donkin.

Penrith-Alston Overhead Line

Cumberland County Council has approved, for a limited period of ten years, a proposal by the North Western Electricity Board to construct a 33 kV overhead line from Penrith to Alston, a distance of 19 miles, to cope with industrial developments. The Board informed the County Council that the line was urgently needed and should be completed by the summer of this year.

Scottish Board's Electricity Charges

APPEALS by the South of Scotland Electricity Board against a decision by the Court of Session, Scotland, that actions by the British Oxygen Co. and British Oxygen Gases, Ltd., should go to trial have been heard in the House of Lords. The British Oxygen Co. alleged that "undue discrimination" had been exercised by the South West Scotland Electricity Board (now merged in the South of Scotland Electricity Board) against high-voltage consumers in that the Board's fuel-variation clause failed to take account of the fact that h.v. supplies cost the Board less than l.v. supplies. The repayment of £10,000 alleged to have been overcharged was claimed by the company.

As reported in the *Financial Times*, it was submitted for the Board that during the period in question the company had paid less than l.v. consumers and thus had not been discriminated against. The Board was not required to relate its charges to the cost of supplying a consumer. Even if the company had been discriminated against it had no right to the repayment of the sum claimed.

Council for the company replied that the Board had admitted that it took into consideration the difference between the cost of supplying h.v. and l.v. energy in its tariffs. Thus the Board could not say that the cost of supplying electricity was irrelevant. The Scottish Court had held that if the company had been discriminated against it was entitled to claim repayment of the amount overcharged.

In the similar action by British Oxygen Gases, Ltd., it was contended that the Board had further discriminated against the company by not taking into account its steady demand throughout the year. The Board's monthly maximum demand tariff meant higher charges than an annual tariff and it was maintained that this provided a further ground for inquiring whether there had been undue discrimination.

After a nine-day hearing the House of Lords reserved judgment.

Street Lighting Plans

Kensington Works Committee has recommended the Council to approve in principle the carrying out of Stage 2 of the scheme for improving the street lighting in the borough. Conversion of all remaining Group "B" gas lighting to electricity is estimated to cost £68,600; the changeover of lighting in individual streets from tungsten to fluorescent to conform with surrounding streets, £5,000; and the conversion on the east-west routes, including new islands where necessary and alterations to traffic signal heads, etc., to Group "A" lighting, £100,960.

Barry (Glamorgan) Council has placed an initial order with Siemens Edison Swan, Ltd., for a number of "Cathay" fluorescent pole-top lanterns in gay colours on Malayan kapur timber columns which need no maintenance and are not subject to deterioration. The poles and lanterns have been approved by the Council of Industrial Design.

The Ministry of Transport and Civil Aviation has approved the whole of the **Houghton-le-Spring** U.D.C.'s scheme for improving the lighting of classified roads within the district. Sanction is being sought to borrow £15,255 to cover the cost of the work.

Financial Section

STOCKS and SHARES

WITH the announcement of the date as 7th April, the Budget has now come to the fore as a main factor in the early outlook for Stock Exchange markets. Hopes of tax concessions appear to be of some assistance in maintaining share prices on a reasonably steady keel. Meanwhile, individual dividend declarations and company reports are the usual cause of any large changes in quotations. Companies associated with domestic equipment continue to produce much of the best news in that respect. Hoover, Morphy-Richards, British Vacuum Cleaner, Vactric, Bylock and Ada (Halifax) are among the companies which have recently contributed evidence of the upswing in business since the removal of hire-purchase restrictions.

A.E.I. Results

An improvement in Associated Electrical Industries £1 shares to 55s 9d registered market satisfaction with the company's preliminary statement on the results of 1958. Maintenance of the dividend at a total of 15 per cent had been generally expected. It is payable on increased capital, but with group profits up by more than a million, to £11·1 million, the net surplus of a little over £5 million, after tax, covers the distribution rather more than 1½ times, or with a slightly wider margin than before. Part of the expansion of earnings would be attributable to the acquisition during the year of the businesses of Associated Insulation Products and W. T. Henley's. Most of the pre-acquisition profits from these sources are being placed to a consolidated reserve. The subsequent offer (now announced to be unconditional) to acquire the London Electric Wire business belongs, of course, to the current year. At their present price, A.E.I. shares show a yield of close on 5½ per cent.

Firm Features

With encouragement from the A.E.I. statement, which confirmed the good impression made earlier by English Electric's annual report, leading electrical shares remained one of the firmer sections of a generally rather uncertain industrial market. English Electric shares were themselves a good feature with another rise of 1s 3d to 65s. Crompton Parkinson and Reyrolle were favoured and there was strong support for Brook Motors, which gained half-a-crown to 53s 9d. Midland Electric Manufacturing at 43s 3d reflected satisfaction with the earlier declaration of a larger distribution. Sun Electrical were marked up by 2s 6d to 73s, and Murex at 48s 3d recovered 3s 3d of the previous losses.

Mixed Changes

Domestic equipment shares have been showing some irregularity after their high activity of previous weeks. Despite the very impressive figures in the 1958 accounts, Hoover were quoted at 1s 6d lower after the appearance of the full report, which struck a cautionary note in some respects, and British Vacuum Cleaner were similarly inclined

Price Changes in

Company or Board	Nom. Value	Middle price 9th March	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1958 Highest	1958 Lowest
						£ s d		
Gilt-edged Stocks								
Brit. Elec. 1968/73	100	78½		3	3	3 16 6	77	72
Brit. Elec. 1974/77	100	75½		3	3	3 19 6	73½	68½
Brit. Elec. 1976/79	100	80	−½	3½	3½	4 7 6	78½	72
Brit. Elec. 1974/79	100	88½		4½	4½	4 16 0	87½	82½
Overseas Electric Supply								
Calcutta Elec.	£1	17/-		6·8†	7†	14 5 0	17/6	15/-
East African Power	£1	19/6	−1/-	7½	8	8 4 3	23/-	17/6
Nigerian Elec.	£1	15/-		10	10	13 6 9	17/-	12/6
Perak Hydro-Elec.	£1	14/6	+6d	12½	10	13 16 0	15/6	13/6
Electrical Shares								
Aberdare Holdings	5/-	16/-		17½	17½	5 9 6	15/9	9/9
Aerialite	1/-	8/9	+3d	51½	54	6 3 6	8/6	5/1
Allen, W. H.	£1	43/9		10	11	5 0 6	43/9	32/9
Anglo-Portuguese Tel.	£1	28/3		8	9	6 7 6	29/3	19/9
Aron Elec. Ord.	£1	60/-		15	15	5 0 0	61/3	53/-
Assoc. Elec. Ord.	£1	55/9	+9d	15	15	5 7 6	58/9	46/6
Automatic Tel. & El.	£1	80/-		17	17	4 5 0	75/-	57/-
Babcock & Wilcox	£1	50/-	−1/3	15	13‡	5 4 0	54/6	41/9
Bakelite	10/-	26/3	+2/-	15	15	5 14 3	23/-	17/6
Baldwin, H. J.	2/-	2/6		20	20	—	3/9	2/6
Berry's Electric	5/-	12/9	+1/-	10	10	3 18 6	11/3	5/9
Bowthorpe Holdings	2/-	12/3		37½	25*	4 1 9	11/9	6/6
British Elec. Traction: Def. Ord. "A"	5/-	36/-	−3d	25	25	3 9 6	40/-	19/6
B.I. Callender's	£1	48/-		12½	12½	5 4 3	52/-	38/9
B.I. Callender's 6% Pref.	£1	20/-		6	6	6 0 0	20/3	19/-
British Thermostat	5/-	38/9		25	30	3 17 6	36/3	19/9
British Vac. Cleaner	5/-	7/-	−6d	10	7½*	5 7 3	4/6	2/3
Brook Motors	10/-	53/9	+2/6	25	24½*	4 10 0	45/-	27/9
Bulgin, A. F.	1/-	7/9		40	45	5 16 3	7/-	4/7
Bulpitts	5/-	12/-		—	12½‡	5 4 3	11/-	7/3
Burco Dean	5/-	12/6		22½	16*	6 8 0	12/6	7/9
Cable & Wireless: Ord.	5/-	12/9		10	10*	3 18 6	13/-	8/-
4% Loan	100	94½		4	4	4 4 9	94½	89
Chloride El. Storage "A"	£1	70/-		17½	17½	5 0 0	68/9	55/6
Clarke Chapman	£1	61/3		27½	13½*	4 9 9	72/6	55/-
Cole, E. K.	5/-	19/3		17½	17½	4 11 0	18/-	15/3
Contactor Switchgear	5/-	12/6		20	14*	5 12 0	13/-	9/-
Cossor, A. C.	5/-	7/3		2½	Nil	Nil	7/9	4/4
Crabtree	10/-	29/-		20	20	6 18 0	32/-	24/4
Crompton Parkinson	5/-	13/-	+3d	16	12*	4 12 3	13/9	8/3
Davis & Timmins	5/-	14/6	−6d	22½	18	6 0 0	16/3	10/3
De La Rue	10/-	31/6	+3d	35	17½*	5 11 0	34/-	20/9
Decca "A"	4/-	37/-	+9d	43½	50	5 8 0	37/6	21/3
Desoutter	5/-	22/6	+2/9	32½	21½*‡	4 16 3	19/3	13/6
Dewhurst	2/-	7/6		20	20	5 6 9	9/3	6/9
Dictograph Tel.	2/-	7/6		20	20	5 6 9	7/3	4/7
Dubilier Condenser	1/-	3/9	+3d	30	20*	5 6 9	4/3	3/1
Duport	5/-	10/6		25	12½*	5 19 0	10/9	7/9
E.M.I.	10/-	53/6	+6d	15	20*‡	3 14 9	52/6	20/9
Electrical Components	5/-	11/6		12½	12½	5 8 9	10/9	7/-
Elec. Construction	£1	30/-		8½	8½	5 13 3	28/9	21/-
Elliott-Automation	5/-	17/6		—	10‡	2 17 3	19/9	11/6
Enfield Cable Ord.	£1	19/6	−6d	Nil	2½	2 11 3	18/9	10/9
English Electric	£1	65/-	+1/3	14	14	4 6 3	60/-	44/-
English Electric 3½% Pref.	£1	12/6		3½	3½	6 0 0	12/6	11/9
Ericsson Tel.	5/-	26/9		22†	12*‡	3 17 3	26/3	17/6
Ever Ready	5/-	26/3		37½	20*	3 16 3	22/3	13/9
Falk Stadelmann	£1	47/6	−6d	17½	15	6 6 3	46/3	35/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡Dividend indicated.

at 7s. On the other hand, there was a rise of 1s in Berry's Electric to 12s 9d, and Ada (Halifax) advanced further to 3s 4½d in anticipation of the coming "rights" issue. Elsewhere, Taylor Tunnicliff were quoted a few pence lower, at 18s 3d, after the announcement of the annual results: net profits for 1958 expanded by about 13 per cent, but the dividend remains at 17½ per cent, as before. There was a rise of 2s to 26s 3d in Bakelite in anticipation of the coming dividend declaration. Dealings began in Rediffusion new 5s shares at a premium of about 4s 9d on the price of 29s at which they are offered to present shareholders.

Electrical Investments

Company or Board	Nom. Value	Middle price 9th March	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1958 Highest	1958 Lowest
Electrical Shares—continued								
G.E.C.	£1	31/3	−1/3	12½	10	6 8 0	40/-	29/3
G.E.C. 6½% Pref.	£1	21/-		6½	6½	6 3 9	21/6	20/3
General Cables	5/-	8/9		24	15	8 11 6	11/9	8/3
Greenwood & Batley	£1	79/6		17½	20	5 0 9	57/6	45/-
Hackbridge Holdings	5/-	15/-	−3d	20	20	6 13 3	15/3	7/6
Hackbridge & Hewittic	5/-	15/-		20	20	6 13 3	14/6	9/7
Head Wrightson	5/-	25/9		22½	17½*	3 8 0	26/-	16/9
Heatrae	2/-	9/-		15	20	4 9 0	7/9	4/-
Holophane	5/-	15/9		37½	22½*	7 2 9	15/6	12/6
Hoover	5/-	62/-	−1/6	50	60	4 16 9	58/6	31/-
I.C.I.	£1	34/9	−9d	10	12	4 12 0*	37/6	23/9
Intl. Combustion	5/-	33/9		25	30‡	4 9 0	28/3	19/3
Intl. Computers & T.	£1	67/6	−6d	—	8‡	2 7 6	—	—
Johnson & Phillips	£1	24/-	−6d	10	5	4 3 3	25/-	15/-
Lancashire Dynamo	£1	47/6		11	11	4 12 6	45/-	28/6
Laurence Scott	5/-	17/3		15	15	4 7 0	16/9	12/6
Lister, R. A.	£1	39/-	−1/-	10	12½	6 8 3	34/6	23/-
London Elec. Wire	£1	71/3	+1/3	12½	12½	—	72/-	39/6
Lucas, J.	£1	45/-		7½	10‡	4 8 6	45/-	27/9
Marconi Marine	£1	41/3		10	10	4 17 0	40/-	29/-
Marryat & Scott	2/-	9/-		35	37½	4 3 3*	8/9	5/3
Mather & Platt	£1	42/-	−6d	15	10‡*	5 1 6	50/6	29/6
Metal Industries	£1	45/-	−6d	9	14	6 4 6	44/-	22/9
Midland Elec. Mfg.	£1	43/3	+9d	12½	10*	4 12 6	41/3	26/6
Morphy-Richards	4/-	22/6		20	20	3 11 0	20/-	14/6
Murex	£1	48/3	+3/3	20	17½	7 5 0	59/3	46/9
Newman Ind.	2/-	2/9		10	10	7 5 6	2/9	2/3
Oldham & Son	1/-	2/6		17½	17½	7 0 0	3/-	2/3
Parsons, C. A.	£1	50/-	−1/3	8½	7½*	3 0 0	55/-	43/-
Plessey	10/-	72/6		30	30	4 2 9	72/6	55/-
Pye	5/-	15/-	−3d	12½	12½	4 3 3	17/-	10/-
Pyrotenax	5/-	35/-		—	27½‡	3 17 6	37/-	27/6
Reliance Clifton	5/-	17/6	−1/-	13½	15	4 5 9	19/9	9/-
Reyrolle	£1	95/-	+6d	17½	17½	3 13 9	93/9	73/6
Rheostatic	4/-	8/9		12½	12½	5 14 3	8/6	6/-
Richardsons Westgarth	10/-	15/-	+3d	16½	8½*	5 11 0	15/9	13/-
Scottish Cables	4/-	15/3		27½	27½	4 4 0*	12/3	7/-
Simon-Carves	5/-	30/9		20	25	4 1 3	31/3	22/6
Smith (England), S.	4/-	12/3		20	12½*‡	4 1 9	12/3	7/-
Southern Areas	£1	11/6	−6d	7½	Nil	Nil	13/9	9/3
Strand Elec.	5/-	8/9	−6d	15	15	8 11 6	9/3	4/9
Sturtevant	5/-	18/6		15†	15†	7 1 0	19/6	14/9
Sun Elec.	£1	73/-	+2/6	25	25	6 17 0	60/6	47/3
Switchgear & Cowans	5/-	11/9		25	22½	4 15 9*	9/9	4/6
Taylor Tunnicliff	5/-	18/3	−6d	17½	17½	4 16 0	18/3	11/9
T.C.C.	10/-	40/-	+1/-	25	25	6 5 0	38/6	32/6
Telephone Mfg.	5/-	5/3		10	10	9 10 6	5/9	4/3
Telephone Rentals	5/-	13/-		12½	12½‡*	4 16 3	14/6	9/9
Thompson (John)	5/-	24/3	+6d	25	25	5 3 0	27/-	23/-
Thorn Elec.	5/-	35/-	+6d	17½	17½	2 10 0	25/-	17/-
Thornycroft	£1	21/3		12½	7½	7 1 3	30/9	21/-
Tube Investments	£1	80/-	−3/-	15	17½	4 7 6	81/3	48/3
Vactric	5/-	40/-		25	25	3 2 6	—	—
Veritys	5/-	2/6		12½	2½	—	6/9	5/3
Walsall Conduits	4/-	18/3		20	22½	4 18 9	18/3	11/-
Ward & Goldstone	5/-	37/-	−6d	40	25*	3 7 6	37/-	23/6
Watford	2/-	7/9	−3d	25	25	5 3 3*	8/-	4/-
Westinghouse	£1	43/9		10	10	4 11 6	45/-	32/3
West, Allen	5/-	13/3	+6d	15	12½*	4 7 9‡	13/3	7/9
Wolf Electric	5/-	8/3		20	10*	6 1 3	9/-	6/9

Desoutter Brothers

Holders of Desoutter Brothers (Holdings) 5s shares have had their dividend increased in each of the years since the holding company was made public in 1951. For the year ended last September the company is paying a final dividend making effectively the same total as before and is supplementing it with a special interim of 1¾d per share on account of 1959 (presumably with reference to the change in profits tax). The total distribution comes to 21⅝ per cent and the yield on the 5s shares, which were marked up to 22s 6d after the announcement, becomes a fraction over 4¾ per cent. Earnings after tax have improved by about 6 per cent to £286,000, which provides more than threefold cover for the amount of the dividends. The ordinary capital of the company is £700,000, divided equally between ordinary and "A" non-voting shares.

Company News

Telegraph Condenser's trading profit expanded by more than £100,000, to £529,000, in 1958, and made good with plenty to spare the moderate recession of earnings reported a year ago. The dividend is held at the total of 25 per cent which has been paid since the 100 per cent scrip issue of 1954. Quoted 1s higher after the announcement at 40s, the 10s shares show a yield of 6¼ per cent. Having risen earlier to 22s 6d on the announcement of an increase in the interim dividend, Morphy-Richards 4s shares showed no further change after the company's report of a 25 per cent increase in turnover, to £5 million, in the last six months of 1958, thanks in large part to the Astral subsidiary's output of refrigerators and spin-dryers.

Decca Prospects

Decca Record's recent annual meeting, at which the accounts for the year ended March, 1958, were presented, was held within a few weeks of the end of the next financial period, concluding this month, so that Mr. E. R. Lewis was in a position to give shareholders a good idea of what to expect from the 1958–59 results. These should again be very satisfactory, he said, and continued progress in the group's varied fields of activity could be anticipated. As known previously, the net profit of the group, after tax, expanded by 60 per cent to £931,000 in 1957–58. Dividends were raised to a total of 50 per cent, an increase of 6¼ per cent, and the nominal value of the shares is to be written up from 4s to 10s through the capitalisation of reserves. Last year's group turnover increased to well over the £20 million mark. The "A" shares have subsequently been firm at 37s, the yield at this price being nearly 5¼ per cent.

REPORTS and DIVIDENDS

Associated Electrical Industries, Ltd.—A preliminary statement of the financial results for the year ended 31st December last shows a net income of £11,069,056, before taxation, after taking into account all charges, including depreciation of £4,791,392, as compared with £9,988,476 for 1957. Taxation absorbs £5,968,241, and the net balance is £5,100,815 (against £4,504,075), of which £4,995,805 is attributable to A.E.I., Ltd. Of this, £1,395,113 is retained by subsidiaries, leaving £3,600,692 available for appropriation. A sum of £500,000 is put to the general reserve of the holding company, and it is proposed to pay a final dividend on the ordinary stock of 7½ per cent, again making 15 per cent for the year. The final dividend is in respect of £38,303,829 ordinary stock; quarterly interim dividends totalling 7½ per cent have already been paid on the stock in issue at the dates of payment. The amount of ordinary stock on which the third interim and final dividends are payable includes stock issued after 31st December last to ordinary stockholders in W. T. Henley's Telegraph Works Co., Ltd., who did not accept the offer of an exchange into A.E.I. ordinary stock before 31st December. The balance carried forward is £523,251 (against £748,571 brought in).

Morphy-Richards, Ltd.—In an interim report covering the half-year to 31st December last, Mr. F. P. Bishop (chairman) says that the group turnover exceeded £5 million, an increase of more than 25 per cent on the figure for the corresponding period of 1957. This was mainly due to the increased production and sales of refrigerators and spin dryers made by the Astral subsidiary at Dundee. The turnover of the parent company also rose, and there was a modest improvement in the profit margin. For seasonal reasons the second half of the financial year is normally less favourable, especially for the sale of many of the main products of the parent company. Sales are also now suffering from the pre-Budget uncertainties. For these reasons it is not expected that turnover or profits in the second half can equal those of the first. In the export field they have established their own sales company in Holland—within the new Common Market. Planned expansion at Dundee goes ahead steadily and the company hopes in the next few months to make further headway in increasing production to meet the demand.

As we reported in our last issue, the interim dividend has been raised from 8 per cent to 10 per cent.

Desoutter Brothers (Holdings), Ltd., reports a group profit for 1958 of £603,266, as compared with £574,556 for 1957. Taxation requires £308,459, leaving a net balance of £294,807 (against £273,164), of which £285,791 is attributable to the company. General reserve receives £150,000. It is proposed to pay a final dividend of 7½d per 5s ordinary and "A" ordinary share, making 11½d per share (same equivalent) for the year, and in addition to pay a special interim dividend of 1½d per share for 1959. The balance carried forward is £179,317 (against £157,441 brought in).

Veritys, Ltd.—At an extraordinary meeting of stockholders on Monday resolutions were passed for the voluntary liquidation of the company, the appointment of Mr. W. G. A. Russell as liquidator and for a scheme of arrangement providing for the Midland Bank to have preferential rights.

At a subsequent meeting of trade creditors a resolution was passed, on a show of hands, for the nomination of Mr. Russell as liquidator, with a committee of inspection. A poll was taken later and the result will be reported to Mr. Justice Roxburgh when he resumes the hearing of the Midland Bank's petition next Monday.

Hoover, Ltd.—The main figures in the accounts for 1958 were given in our last issue. In their review of the year's activities, the directors state that the consolidated profit for the group at £5·8 million shows an increase of 56 per cent on 1957, with turnover of the British companies up by 28 per cent. The reduction of purchase tax in April and the removal of hire-purchase restrictions in October were primarily responsible for the sharp rise in earnings during the latter part of the year. Although sales were stimulated by reductions in purchase tax and the removal of hire-purchase restrictions, even further impetus was added by the introduction to the home market of a new cleaner in October and a new spin dryer in November.

The market for vacuum cleaners and washing machines has become increasingly competitive over the past few years and the necessity for good design, competitive prices and first-class merchandising has never been so vital as it is at the present time. They have strengthened the design and development divisions, but a greater proportion of the revenue will need to be devoted to this field in future years if they are to maintain their position in the world's markets.

The year has been a particularly difficult one in the export market. The recession in the United States, the fall in commodity prices in the primary producing countries and the disturbed political situation in the Middle and Far East militated against the development of trade although the position is now improving slowly. In spite of this, the total export business was maintained at a level close to that of the previous year, and they were again the major exporters of washing machines and vacuum cleaners, responsible for around 70 per cent of the total United Kingdom exports of these appliances. In the American market their dollar earnings were reduced from $3,084,722 in 1957 to $2,216,236 last year. With the return to more normal conditions they hope for an improvement in their trade there. The highlight of their export business has been the success of the "Hoovermatic" washing machine which was introduced in the spring. This has been particularly evident in Australia, and it is of especial value in Western Europe where they face highly competitive conditions. The review makes brief references to the overseas subsidiary companies.

Universal Asbestos Manufacturing Co., Ltd.—The group profit, before taxation, for the period 30th September, 1957, to 28th September, 1958, is £335,237, as compared with £201,358 for 1957, and the net profit of the parent company is £149,630 (against £87,072). It is proposed to pay a final ordinary dividend of 12½ per cent, making 20 per cent for the year, and after placing £70,000 to general reserve the balance carried forward is £151,953 (against £148,567 brought in).

The Telegraph Condenser Co., Ltd., reports a group trading profit of £528,784 for 1958, as compared with £424,301 for the preceding year, to which is added interest and dividends of £5,011, making £533,795. Depreciation requires £80,236 and taxation £238,386. General reserve receives £80,000 and the dividend for the year is maintained at 25 per cent by a final payment of 20 per cent.

J. & E. Hall, Ltd., report a group profit for the year ended 30th September last of £840,678, as compared with £777,003 for 1956-57. After deducting £461,000 for taxation, the net balance is £379,678 (against £364,003). It is proposed to pay a final dividend of 17½ per cent (against 12½ per cent), making 20 per cent (15 per cent) for the year.

Simon-Carves, Ltd., has declared a special distribution of realised capital profits at the rate of 4½d per 5s share to be paid on 3rd April. This distribution is exceptional and will not affect whatever final dividend may be recommended in respect of the year ended 31st December, 1958.

Pirelli-General Cable Works, Ltd.—Application has been made to the London Stock Exchange for permission to deal in and quotation for the newly created £2,000,000 5½ per cent second debenture stock, 1979-82. The stock is being placed through Morgan, Grenfell & Co. at £97 per cent, payable as to £25 per cent on application and the remainder on 6th May next.

Radio Rentals, Ltd.—London and Yorkshire Trust announces in connection with the issue to ordinary

shareholders of 1,600,000 ordinary shares of 5s each at 15s per share that over 99 per cent of the shares provisionally allotted were accepted. The balance available to meet applications for excess shares was very heavily oversubscribed but every applicant will receive a small allotment.

Ultra Electric, Ltd., the wholly owned subsidiary of Ultra Electric (Holdings), Ltd., is to acquire all the issued capital of Pilot Radio, Ltd., for cash as from 1st April. On the same date Ultra will also acquire the "Pilot" trade marks in seventeen European countries from the Pilot Radio Corporation of the U.S.A. The directors consider that the resources currently available to Ultra Electric, Ltd., will be sufficient to meet the payments in respect of these acquisitions and that no issue of shares will be required.

E. K. Cole, Ltd., are paying an interim dividend of 7½ per cent (unchanged).

New Companies

Pye Telephone Co., Ltd.—Registered 12th February. Capital £100. To acquire the rights of access to and the use of the results of research, design and development in telephone apparatus and equipment, the present or future property of Pye, Ltd., or any subsidiary or associated company, etc. Solicitors: Few & Kester, Cambridge.

Novakit, Ltd.—Registered 17th February. Capital £400. Electricians, mechanical engineers, manufacturers, workers and dealers in electrical apparatus and goods, radio and television sets, etc. Directors: P. P. Neve, P. S. Redfearn, C. W. Howson and C. G. Howson. Regd. office: 20, Elsby Avenue, Thornton-Cleveleys, Lancs.

Adler (Electronics), Ltd.—Registered 16th February. Capital £2,000. Manufacturers, importers and exporters and distributors of, agents for and wholesale and retail dealers in and repairers of electrical goods, radio and television receivers, etc. Directors: M. Adler and E. Adler. Regd. office: 132/3, Cheapside, E.C.2.

R. Williamson (Electrical Contractors), Ltd.—Registered in Edinburgh 6th January. Capital £2,000. To acquire the business of electrical engineers and contractors carried on at 130, Duke Street, Glasgow, by R. B. Williamson, etc. Directors: R. B. Williamson and D. G. H. Geddes. Regd. office: 130, Duke Street, Glasgow, C.4.

C. McLean & Co., Ltd.—Registered 20th January. Capital £100. Factors, distributors, merchants and manufacturers of and dealers in electrical, wireless and television apparatus, etc. C. McLean is the first director. Regd. office: 92a, Main Street, Glasgow.

B. & R. Wild (Electrical), Ltd.—Registered 19th February. Capital £1,500. Electrical, radio, television and mechanical engineers, etc. Directors: R. W. Wild and Basil C. A. Wild. Regd. office: 60, Goring Road, Worthing.

Bankruptcies

T. Skipper, formerly carrying on business in partnership with others under the names of T. Skipper, Baldwin & Skipper, and Derbyshire Vac Service at 66, Church Street, Eckington, and at 266, Manor Road, Brimington, Derbyshire, retail electrical goods suppliers.—Receiving order made 24th February on debtor's own petition.

R. P. Dyke and **G. J. Roberts,** lately carrying on business in co-partnership as Eastern Telectrics at 54, Waterloo Road, Norwich, electrical engineers.—Public examination 16th March at the Shirehall, Norwich.

B. Landau, 60, Myrdle Street, Commercial Road, London, E.1, electrical engineer, lately carrying on business at 401, Commercial Road, E.1, and formerly carrying on business at 31, Cannon Street Road, E.1, both in the name of Landau Electrical Co., as a retailer of electrical goods and as electrical contractor.—Order made 23rd January suspending bankrupt's discharge for one year.

R. N. Shaw, a partner in Paramount Vacuums & Electrics, 193, Plashet Road, Plaistow, London, E.13, electrical dealers.—Receiving order made 25th February on a creditor's petition.

Liquidations

Electronic Techniques, Ltd.—Winding up voluntarily. Liquidator, Mr. J. A. Acton, 20, Gwalior House, Chase Road, London, N.14, appointed 13th February.

Truvox Holdings, Ltd.—Particulars of claims by 31st March to Mr. H. Moore, liquidator, Bucklersbury House, Bucklersbury, London, E.C.4.

WELDED ALUMINIUM TUBE

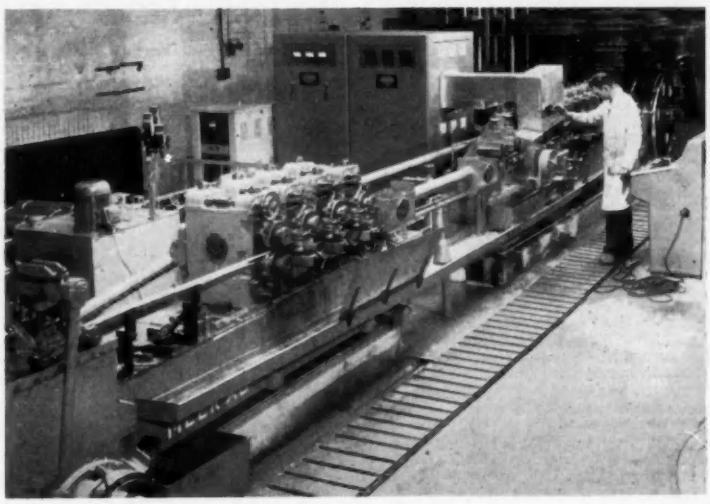
PRODUCTION STARTED IN AYLESBURY FACTORY

A HIGH frequency welding process developed by the New Rochelle Tool Corporation of New York is employed in the production of aluminium tubes at the Aylesbury factory of Elm Engineering, Ltd., a member of the Antiference Group, Ltd. Butt welded tubes ranging in external diameter from ½ to 1½in with wall thicknesses from 14 to 22 gauge can be manufactured by the machine, claimed to be the first in this country producing aluminium tubes, at speeds up to 200 ft/min.

Aluminium strip is taken from a reel and passed through eight pairs of feed rolls, being formed into an almost closed circle. A guide aligns the tube for welding, which is carried out at 1,000 deg F by h.f. power transmitted to each side of the seam by two pressure contact shoes, the two seam faces being closed by a pair of horizontal pressure rolls. A ferrite core mounted in the tube produces a great h.f. impedance in the longer current path round the tube, the current passing directly between seam faces. Two cutting tools remove the external scarf, that formed internally being removed if required by a similar tool or pressure roller mounted within the tube. Four pairs of calibration rolls straighten the tube and govern the outside diameter to within ±0·005in, and it is then divided into the required lengths.

A d.c. supply is obtained from the 440 V three-phase input to the machine by six single anode mercury arc rectifiers, and the 450 kc/s welding power is provided by a push-pull oscillator. The total power requirement is 162 kW, including 50 kW of h.f. power, and a 35 h.p. motor drives the pump for the hydraulic drive and control system of the mill. Micro-analysis has shown that the weld produced is truly homogeneous, and the tubes may be formed, pierced, polished or anodised. Those being made at present will be used in products manufactured by the group, including tubular furniture and television aerials.

The output end of the h.f. welding mill



NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

6678. Midland Dynamo Co., Ltd.—Armature winding machines. 7th June, 1955. (810112.)

18041. United Kingdom Atomic Energy Authority.—Refining metal by electrode-deposition. 6th June, 1955. (810091.)

32566. Ferguson Pailin, Ltd.—Electrical protective systems. 12th December, 1955. (810093.)

1955

6738. Bode, H.—Electronic musical instruments with frequency-divider circuits. 8th March, 1955. (810117.)

7134. Electrical Apparatus Co., Ltd.—Control of electric motors. 10th March, 1955. (810119.)

11444. Radio Corporation of America.—Amplifier circuits. 20th April, 1955. (810291.)

15339. Centre National de la Recherche Scientifique.—Electrostatic focusing of electrons in X-ray tubes. 27th May, 1955. (810121.)

16796. Metropolitan-Vickers Electrical Co., Ltd.—Thermionic cathodes for electron-discharge devices. 5th June, 1956. (810202.)

20067. Mullard Radio Valve Co., Ltd.—Electric circuits employing transistors. 11th July, 1956. (810096.)

20541. Philips Electrical Industries, Ltd.—Transistors comprising alloy electrodes. 15th July, 1955. (810123.)

20910. British Thomson-Houston Co., Ltd.—Protective arrangements for electrical installations. 19th July, 1955. (810299.)

21297. General Electric Co.—Electrodes for fluorescent electric-discharge lamps. 22nd July, 1955. (810301.)

27225. Siemens Edison Swan, Ltd.—Electric contact spring assemblies. 31st July, 1956. (Addition to 760743.) (810098.)

35135. General Electric Co.—Water-repellent materials. 7th December, 1955. (810310.)

36527. Zavody V.I. Lenina Narodni Podnik, Navotny, B., and Opial, M.—Control systems for electrically driven vehicles. 20th December, 1955. (810129.)

1956

2298. Mullard Radio Valve Co., Ltd.—Automatic frequency control circuits. 24th January, 1956. (810311.)

3471. Egyesült Izzolampa es Villamossagi R.T.—Indirectly heated supply cathodes. 3rd February, 1956. (810101.)

5891. Standard Telephones & Cables, Ltd.—Focusing magnet for long electron beams. 24th February, 1956. (Addition to 742070.) (810267.)

6707. Hughes Aircraft Co.—Dielectric support for ferrites in waveguide devices. 2nd March, 1956. (810131.)

7200. Electric Construction Co., Ltd.—Electric control systems. 4th June, 1957. (810315.)

13225. Montgomery Elevator Co.—Load-responsive switch-actuating mechanism for an elevator cage. 30th April, 1956. (810319.)

13990. Parkinson Cowan, Ltd.—Portable convector heaters. 2nd August, 1957. (810104.)

15401. Egyesült Izzolampa es Villamossagi R.T.—Electron discharge valves. 17th May, 1956. (810321.)

15520. Etablissements Ducellier.—Voltage and current regulating systems of dynamos. 18th May, 1956. (810137.)

17844. Sylvania Electric Products, Inc.—Apparatus for transferring partially completed lamps between machines during manufacture. 8th June, 1956. (810056.)

18639. Marie, G. R. P.—Wide-band directional waveguide couplers. 15th June, 1956. (810057.)

18851. Blackstone & Co., Ltd.—Stand-by electricity generator installations. 13th June, 1957. (810139.)

20636. Varian Associates.—High frequency cavity resonator tuner structure. 3rd July, 1956. (810327.)

21067. Thorn Electrical Industries, Ltd.—Winding of electrical coils. 18th June, 1957. (810226.)

22191. Automatic Telephone & Electric Co., Ltd.—Electrical signalling systems. 8th July, 1957. (810354.)

23788. Brown, Boveri & Cie. A.G.—Electric motor and like controllers. 1st August, 1956. (810058.)

24886. Sylvania Electric Products, Inc.—Sealing head orienting apparatus for electric lamp-making machines. 14th August, 1956. (810143.)

26748. Kelvin & Hughes, Ltd.—Radar monitors. 28th August, 1957. (810353.)

27342. Plessey Co., Ltd.—Electrical keyboard switches. 6th September, 1957. (810237.)

27634. Sperry Rand Corporation.—Transistor logical element. 10th September, 1956. (810061.)

28154. Sperry Rand Corporation.—Amplifier circuit arrangements. 14th September, 1956. (810109.)

30170. Bendix Aviation Corporation.—Electric signalling systems using a reflected binary code. 3rd October, 1956. (810333.)

33519. Philips Electrical Industries, Ltd.—Semiconductor devices. 2nd November, 1956. (810361.)

34941. General Electric Co., Ltd.—Cathode-ray tubes. 12th November, 1957. (810110.)

36074. Telefunken G.m.b.H.—Automatic frequency controlling systems. 26th November, 1956. (810153.)

1957

74. Jansen, B.—Electric switches suitable for transformer tap changing. 1st January, 1957. (810157.)

3565. Standard Telephones & Cables, Ltd.—Electrical identification circuit. 1st February, 1957. (810168.)

8210. Accumulatoren-Fabrik A.G.—Lead accumulators with plates of which the grids consist of a lead-mercury alloy. 13th March, 1957. (810175.)

8596. Standard Telephones & Cables, Ltd.—Step-by-step switches. 15th March, 1957. (810072.)

9510. Standard Telephones & Cables, Ltd.—Electrical or telephone jack key or lamp units and assemblies thereof. 22nd March, 1957. (810074.)

14344. Philips Electrical Industries, Ltd.—Solder alloys and methods of soldering together tungsten parts. 6th May, 1957. (810076.)

19202. Sylvania Electric Products, Inc.—Television apparatus. 18th June, 1957. (810181.)

19211. Siemens-Schuckert (Great Britain), Ltd., and Dixon, B. J.—Electrical remote control circuits. 18th June, 1957. (810182.)

27153. Sylvania Electric Products, Inc.—Method of forming image display screens for cathode-ray tubes. 28th August, 1957. (810186.)

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 25th March:

Swanmaid. No. B781,180 and **Swanmaid** (design). No. B781,598. Class 7. Dish washing machines.—Bulpitt & Sons, Ltd., St. George's Works, 132, Icknield Street, Birmingham, 18.

No. 780,033 (design). Class 7. Electrically operated scrubbing, floor waxing, polishing, sanding, etc., machines, none being for domestic use; washing machines, polish spraying machines and drying machines. No. 780,034 (design). Class 9. Vacuum cleaners, vacuum dust extractors and carpet sweeping machines; and scrubbing machines, machines for waxing floors, carpet cleaning, sanding floors, etc., for domestic use.—Rollnick & Gordon, Ltd., Capitol Works, Empire Way, Wembley, Middx.

No. B781,295 (design). Class 7. Electrically operated portable tools for drilling, grinding, screwdriving, sanding, polishing, etc., and electrically operated grinding tools for use on the work bench.—Black & Decker, Ltd., 67, Watling Street, London, E.C.4.

Potpot. No. 769,124. Class 9. Resistors, potentiometers and switches, and encapsulated assemblies.—Clarostat Mfg. Co., Inc., Dover, New Hampshire, U.S.A. Address for service, c/o Marks & Clerk, 57 and 58, Lincoln's Inn Fields, London, W.C.2.

Rega. No. B769,215. Class 9. Electrical and electronic apparatus for use in automatically controlling the action of machinery for industrial plant.—Hans Brucker, trading as Rega, Brucker & Co., Siegburg, Seligenthal-Munchshecke, Germany. Address for service, c/o Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

Rawin. No. 775,277. Class 9. Scientific and electrical apparatus and instruments; optical apparatus and instruments; and measuring and signalling apparatus.—Chemring, Ltd., Bensham Manor Road, Thornton Heath, Surrey.

No. 779,606 (design). Class 9. Electric vacuum cleaners and parts.—Turissa (Great Britain), Ltd., 101-109, Ladbroke Grove, London, W.11.

Boostette. No. 782,440. Class 9. Electric battery chargers.—F. C. Heayberd & Co., Ltd., 114-116, Greenwich South Street, London, S.E.10.

Sauter (design). No. 752,891. Class 11. Ovens, sterilising apparatus (not for surgical purposes), water distilling apparatus (not laboratory apparatus), water heating and water cooling installations and apparatus, heating and drying cabinets, electric steam boilers (not parts of machines), refrigerating installations and apparatus; lighting, cooking, baking and ventilating apparatus and installations.—Fr. Sauter A.G. Fabrik Elektr. Apparate, Basle, Switzerland. Address for service, c/o Abel & Imray, Quality House, Quality Court, Chancery Lane, London, W.C.2.

Revo-Luxe. No. 777,760. Class 11. Electric cooking stoves.—Revo Electric Co., Ltd., Britannia Works, Groveland Road, Tividale, Tipton, Staffs.

Welding Technology

Copies of a leaflet giving details of courses from April to October on welding technology are available from the School of Welding Technology, 54, Princes Gate, London, S.W.7.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

MONDAY, 16th MARCH

Birmingham.—Grand Hotel, 6.15 p.m. Birmingham Electric Club. Annual general meeting, followed by "Impressions of the Brussels Exhibition," by P. W. Lansdown.

Brigg.—Angel Hotel, 6.45 p.m. I.E.E. Sheffield Sub-Centre. Informal discussion on "Electrical Maintenance Problems in Factory and Supply Systems."

Bristol.—At Gardiner, Sons & Co., Ltd., showroom, Broad Plain, 7 p.m. I.E.S. Bath and Bristol Centre. "Airport Lighting," by J. G. Holmes.

Cardiff.—At the South Wales Institute of Engineers, Park Place, 6 p.m. I.E.E. Western Supply Group. "Insulation and Insulation Testing," by H. C. Tucker.

Chester.—Town Hall, 6.30 p.m. I.E.E. Mersey and North Wales Centre. "High Voltage D.C. Transmission with special reference to the Cross-Channel Cable," by F. J. Lane.

The Blossoms, 7.15 p.m. Institution of Plant Engineers, Merseyside and North Wales Branch. Annual general meeting, followed by film "Planned for the Purpose."

Ipswich.—Electric House, 7.15 p.m. Ipswich and District Electrical Association. "Notes on Electric Motor Applications," by H. Richardson.

Leeds.—Town Hall, 7 p.m. I.E.E. North Midland Centre. Faraday Lecture on "Automation," by Dr. H. A. Thomas.

London.—Savoy Place, 6.30 p.m. I.E.E. London Graduate and Student Section. Students' lecture. "Something for Nothing? Heat Pump Achievements," by G. O. McLean.

Manchester.—Engineers' Club, Albert Square, 7 p.m. I.E.E. North Western Graduate and Student Section. "Some Considerations in the Design of a Range of Medium-Sized D.C. Machines," by L. A. Walters.

Newcastle-on-Tyne.—King's College, 6.15 p.m. I.E.E. North Eastern Radio and Measurement Group. "Examples of Geo-electric Surveys," by Professor L. S. Palmer.

Reading.—George Hotel, King Street, 7.15 p.m. I.E.E. district meeting. "Subscriber Trunk Dialling," by D. A. Barron.

Stafford.—Technical College, 7.15 p.m. I.E.E. North Staffordshire Sub-Centre and Graduate and Student Section. Short papers.

TUESDAY, 17th MARCH

Aldershot.—Red Cross Hall, High Street, 7.30 p.m. A.S.E.E. Aldershot and District Branch. "The Nightstor Story," by E. H. Parker.

Bath.—Technical College, 6 p.m. I.E.E. Western Centre. "Electrification of the U.K.A.E.A. Industrial Group Factories," by J. W. Binns and W. J. Outram.

Broadstairs.—Clarendon Hotel, 8 p.m. A.S.E.E. East Kent Branch. "Electrical Safety," by S. J. Emerson.

Cambridge.—Cavendish Laboratory, Free School Lane, 8 p.m. I.E.E. Cambridge Radio and Telecommunication Group. "Reliability of Electronic Components," by G. W. A. Dummer.

Coventry.—Coventry Electric Club. Social evening.

Derby.—E.M.E.B. Service Centre, 6.30 p.m. I.E.E. East Midland Centre. "The Development of Variable-Speed High-Power Drives for Large Wind Tunnels" and "A Variable Frequency Power Installation for Large Wind Tunnel Drives," by P. McKearney, L. S. Drake and E. G. Mallalieu.

Edinburgh.—Carlton Hotel, North Bridge, 7 p.m. I.E.E. South East Scotland Sub-Centre. "The Application of Transistors to Line Communication Equipment," by H. T. Prior, D. J. R. Chapman and A. A. M. Whitehead.

Liverpool.—Merseyside and North Wales Electricity Board, Industrial Development Centre, 6 p.m. I.E.S. Liverpool Centre. "Some Advances in Materials for Lighting, 1909-59," by W. E. Harper.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurement and Control Section. "Electrical Uses of Atomic Spin," by G. Phillips.

Manchester.—Engineers' Club, Albert Sq., 6.15 p.m. I.E.E. North Western Utilisation Group. "Electrical Installation at Calder Hall," by N. J. Mackay and E. Hardwick.

Rugby.—College of Engineering Technology, 6.30 p.m. I.E.E. Rugby Graduate and Student Section. Annual general meeting and film evening.

TUESDAY, 17th MARCH to SATURDAY, 21st MARCH

London.—Earls Court. Electrical Engineers' Exhibition.

WEDNESDAY, 18th MARCH

Birmingham.—Chamber of Commerce, New Street, 10 a.m. Combustion Engineering Association, Midland Region. "The Use of Small Coals for Steam Raising," by E. Otty.

Bristol.—The University, 7 p.m. I.E.E. Bristol Graduate and Student Section. "Some Principles Developed in the Application of Digital Computers to the Design of Electrical Plant," by B. J. Chalmers. (Rearranged meeting.)

Cardiff.—Park Hotel, 6.15 p.m. Institution of Plant Engineers, South Wales Branch. "Bridging the Atlantic," by A. H. Mumford.

Halifax.—Percival Whitley College of Further Education, 7.30 p.m. Institution of Production Engineers. "The Production of Power from Nuclear Energy," by A. L. Shaw.

Kendal.—North Western Electricity Board, Finckle Street, 7.15 p.m. I.E.E. North Lancashire Sub-Centre. "British Columbia-Vancouver Island 138 kV Submarine Power Cable," by Dr. T. Ingledow, R. M. Fairfield, E. L. Davey, K. S. Brazier and J. N. Gibson.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Electronic and Communications Section. "New Amplifying Techniques," by C. W. Oatley.

Manchester. — Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North Western Radio and Telecommunication Group. "Bridging the Atlantic," by A. H. Mumford.

Middlesbrough.—Cleveland Scientific and Technical Institution, Corporation Road, 6.30 p.m. I.E.S. Tees-side Group. "Lighting in 1984," by E. E. Miles.

Newcastle-on-Tyne. — King's College, Stephenson Buildings, 7 p.m. Society of Instrument Technology, Newcastle Section. "Operating Experiences on Automatic Control of Large Steam Generators," by J. S. Holt.

Nottingham. — Mechanics' Institution, Trinity Square, 7.30 p.m. A.S.E.E. Nottingham Branch. Open Forum—discussion on I.E.E. Regulations.

Preston.—North Western Electricity Board, 19, Friargate, 7 p.m. I.E.S. North Lancashire Group. Annual general meeting, followed by "Commercial and Industrial Lighting," by A. Temple.

Wolverhampton.—District Bank Chambers, Lichfield Street, 7.45 p.m. A.S.E.E. Wolverhampton and District Branch. "Light Sources with Particular Reference to Electro-Luminescence," by G. V. McNeill.

THURSDAY, 19th MARCH

Cardiff.—Park Place, 6 p.m. South Wales Institute of Engineers. "The Electrical Aspects of the Continuous Miner at Trelewis Drift Mine," by H. Pritchard.

Chelmsford.—Hoffmann's Social Hall, 7.30 p.m. Chelmsford Engineering Society. "Prediction and Measurement of Television Service Areas," by G. Millington.

Dublin.—Trinity College, 6 p.m. I.E.E. Irish Branch. "Network Analysers—Why and Wherefore," by W. P. Leech.

Edinburgh.—George Hotel, 7 for 7.30 p.m. I.E.E. Scottish Centre. Annual dinner.

Glasgow.—39, Elmbank Crescent, 7 p.m. British Institution of Radio Engineers, Scottish Section. "Application of Magnetic Amplifiers to Electrical Switching," by J. A. Purdie.

London.—Connaught Rooms, W.C.2, 3 p.m. British Electrical and Allied Manufacturers' Association. Annual general meeting.

Dorchester Hotel, W.1. Electrical Wholesalers' Federation. 10 a.m. Annual general meeting. 6.30 for 7 p.m. Annual dinner.

London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, 6.30 p.m. British Institution of Radio Engineers. "Instrumentation in Field Physiology," by Dr. H. Wolff.

Manchester.—Engineers' Club, 6.45 p.m. Institution of Mechanical Engineers, North Western Branch. "Special Design and Construction Features of the Bradwell Nuclear Power Station," by G. H. Inglis.

Middlesbrough.—Cleveland Scientific and Technical Institute, Corporation Road, 7.30 p.m. Society of Instrument Technology, Tees-side Section. Annual general meeting. "Flow Measurement: Some Problems and Devices of Special Interest," by W. J. Clark.

Newcastle-on-Tyne.—City Hall, 7 p.m. I.E.E. North Eastern Centre. Faraday Lecture on "Automation," by Dr. H. A. Thomas.

Peterborough.—White Lion Hotel, Church Street, 7.30 p.m. Institution of Plant Engineers, Peterborough Branch. Annual meeting.

THURSDAY, 19th MARCH and FRIDAY, 20th MARCH

London.—Savoy Place, W.C.2. I.E.E. Electronic and Communications Section. Convention on Stereophonic Sound Recording, Reproduction and Broadcasting.

FRIDAY, 20th MARCH

Birmingham.—Imperial Hotel, Temple Street, 7.30 p.m. Institution of Plant Engineers, Birmingham Branch. Annual general meeting, followed by films on welding.

Cardiff.—At the South Wales Institute of Engineers, Park Place, 7 p.m. Institution of Production Engineers, Wales Region. Annual general meeting, followed by "Engineering Ceramics," by C. G. Martin.

Chelmsford.—Crompton's Social Hall, 7.15 p.m. Chelmsford Engineering Society. Conversazione.

Coventry.—St. Mary's Hall. I.E.S. Birmingham Centre. "Architecture of Light," by R. Helburg.

Edinburgh.—The University, Drummond Street, 7 p.m. British Institution of Radio Engineers, Scottish Section. "Application of Magnetic Amplifiers to Electrical Switching," by J. A. Purdie.

Glasgow.—425, Sauchiehall Street, 7.15 p.m. Society of Instrument Technology, Scottish Section. Annual general meeting.

Hanley.—Grand Hotel, 7.30 p.m. A.S.E.E. Stoke and Crewe Branch. "Cable Insulation."

London.—Connaught Rooms, W.C.2, 12.30 for 1 p.m. British Refrigeration Association. Annual luncheon.

Connaught Rooms, W.C.2, 7 for 7.30 p.m. Batti-Wallahs' Society. Ladies' night.

1, Birdcage Walk, S.W.1, 6 p.m. Institutions of Electrical, Civil and Mechanical Engineers. Joint meeting. Fifth Graham Clark Lecture by Sir Arnold Plant.

Manchester.—Engineers' Club, 6.45 p.m. Manchester Association of Engineers. Annual general meeting. "Production Investigations Applied in Practice," by Dr. N. Dudley and Dr. E. Koenigsberger.

Engineers' Club, Albert Square, 6.30 p.m. Institution of Heating and Ventilating Engineers, Manchester and District Branch. Annual meeting and chairman's address.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—Snowy Mountains Hydro-Electric Authority, Cooma North, N.S.W. 7th April. Hydraulic and electric control equipment for outlet gates of the Tooma Tumut control structure. (E.S.B. 4796/59. Ten/37627.)*

Carlisle.—City Council. 31st March. Electrical installation, Harraby Secondary School extensions. City engineer, 18, Fisher Street.

Castle-Douglas.—Corporation. 6th April. Trunk road lighting equipment. (See this issue.)

France.—Purchasing and Contracting Officer, ACE Communications and Electronic equipment, S.H.A.P.E., Paris. 24th March. 385 telephones. (E.S.B. 5955/59. Ten/37806.)*

Fylde.—Water Board. 10th April. Two vertical electrically driven centrifugal pumping sets. Engineer to the Board, Sefton Street, Blackpool.

Greece.—Ministry of National Defence, Athens. 19th March. Electric cable. (E.S.B. 4782/59. Ten/37620.)*

Helmsley.—R.D.C. 13th April. Electrically operated pumping plant. Arnold Brooksbank & Son, consulting engineers, 48, Sunbridge Road, Bradford, 1.

Korea.—Government Office of Supply, Seoul. 25th March. Plant and equipment for 2,000 kVA substation. (E.S.B. 4893/59/I.C.A. Ten/37655.)*

Longbenton.—U.D.C. 11th April. Street lighting equipment. (See this issue.)

Midlothian.—County Council. 3rd April. Street lighting equipment. (See this issue.)

Peterhead.—Corporation. 4th April. Trunk road lighting equipment. (See this issue.)

Rhodesia and Nyasaland.—Federal Tender Board, Causeway. 20th March. Short wave therapy and hyperthermy apparatus. (E.S.B. 5514/59. Ten/37743.)* Diathermy unit. (E.S.B. 5515/59. Ten/37744.)*

Southern Rhodesia Electricity Supply Commission, Salisbury. 9th April. 88 kV isolating and earthing switches. (E.S.B. 5567/59. Ten/37727.)*

Richmond (Yorks).—R.D.C. 25th March. Electrically operated pumping plant, in duplicate, for Hudswell water scheme (Contract No. 2). Arnold Brooksbank & Son, consulting engineers, 48, Sunbridge Road, Bradford, 1.

South Africa.—Stores Department, South African Railways, Johannesburg. 20th March. H.v. switchboards. (E.S.B. 4620/59. Ten/Ten/37548.)* Air break isolators. (E.S.B. 4615/59. Ten/37549.)* Power and lighting transformers. (E.S.B. 4621/59. Ten/37575.)* 25th March. Carrier equipment. (E.S.B. 4430/59. Ten/37541.)*

Transvaal Provincial Tender Board, Pretoria. 20th March. Radio sets and loudspeakers. (E.S.B. 5836/59. Ten/37788.)*

Union Tender Board, Pretoria. 26th March. Tumbler switches. (E.S.B. 4826/59. Ten/37611.)*

Cape Town Electricity Department. 31st March. House service electricity meters. (E.S.B. 5727/59. Ten/37779.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

Durban Corporation. 3rd April. 33 kV 3-core solid, oil filled or gas filled cable. (E.S.B. 4833/59. Ten/37612.)*

Thailand.—Thai Technical and Economic Committee, Bangkok. 26th March. Power plant including three 1,000 kW diesel generating sets, switchgear and auxiliary equipment. (E.S.B. 5583/59/I.C.A. Ten/37750.)*

Uruguay.—Administracion General de las Usinas Electricos y los Teléfonos, del Estado. 7th April. Electricity meters. (E.S.B. 5299/59. Ten/37685.)*

Uxbridge.—Borough Council. 23rd March. Street lighting lamps (Form No. 16), for the year ending 31st March, 1960. H. E. G. Stripp, borough surveyor, 263, High Street.

West Hartlepool.—Corporation. 6th April. Electrical installation in 27 three-storey flats in the central area of the town. A. G. Sinclair, borough architect.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Aberystwyth.—Laboratories for Ardwyn Grammar School; county architect, County Hall, Aberayron.

Ailesworth.—Private housing estate, Peterborough Road (50 houses and bungalows); C. W. Shelton, Ltd., builders, Eastgate, Peterborough.

Basingstoke.—Municipal offices, etc., and assembly hall, Hackwood Road/London Road corner site; E. Almond, borough architect, Municipal Buildings.

Billingham-on-Tees.—Houses (155), Marsh House Avenue; U.D.C. surveyor.

Bracknell.—Multi-storey buildings for new centre for the Meteorological Office; Architects' Department, Ministry of Works, Abell House, John Islip Street, London, S.W.1.

Brierley Hill.—Public baths, Cottage Street; J. R. Moore, housing director, Civic Buildings.

Bungay (Suffolk). — Grammar school (£120,000); E. J. Symcox, East Suffolk county architect, County Hall, Ipswich.

Canterbury.—Reconstruction of "Slatters," St. Margaret's Street, to form hotel and banqueting room (£100,000); E. C. Kent, architect, 6, Gray's Inn Road, London, W.C.1.

Carlisle.—Additions to Carlisle Grammar School (£57,000), and Creighton Secondary School (£53,000); city engineer, 18, Fisher Street.

Chipping Norton.—Flats (40), Albion Street; borough surveyor.

Croydon.—Houses (216) as third stage redevelopment of Shrublands estate; borough engineer, Town Hall, Katharine Street.

Dundee.—Factory for Wright Dental Manufacturing Co., Peter Street; James B. Hay & Co., Ltd., 6, Guthrie Street.

Eastbourne.—Concert and conference hall, Winter Garden site; A. F. Myers & Partners, electrical and mechanical consultants, 147, Victoria Street, London, S.W.1.

Edinburgh.—Laboratory buildings at the Western General Hospital (£125,000); Regional Hospital Board, 18, Rothesay Terrace, Edinburgh, 3.

Exeter.—St. James' Secondary School for Girls, Summer Lane; Stephens & Son, Ltd., builders, 162, Sidwell Street.

Grantham.—Earlesfield C.E. (Controlled) School (£142,046); Kesteven county architect, Sleaford, Lincs.

Harlow.—Odeon cinema; Geo. Wimpey & Co., Ltd., builders, Hammersmith Grove, London, W.6.

Hebburn.—Rebuilding mill for Thubron Timber Co.; H. Gatoff, architect, 51, Grainger Street, Newcastle-on-Tyne.

Horsham.—Infirmary block (£29,000), Forest Hospital; E. C. Andrews Building & Construction Co., Ltd., Middle Street.

Huddersfield.—Erection of Rawthorpe County Junior School; borough architect, High Street Buildings.

Hull.—Departmental store for C. & A. Modes, Ltd.; Pauling & Co., Ltd., builders, 26, Victoria Street, London, S.W.1.

Leicester.—New offices for Leics. C.C. (£800,000); county architect, Leicester.

Long Ashton.—Houses (178); surveyor, Council Offices, Cambridge Batch, Flax Bourton, near Bristol.

Lymm.—Bungalows (70), Hardy Road; E. Entwistle, Ltd., builders, 34, Victoria Street, Altrincham.

Maidstone.—Workshops and offices; Maidstone Tyre Co., Ltd., 3/5, Sandling Road.

Meriden.—Council offices, etc., Coleshill; Jackson & Edmonds, architects, Colmore Row, Birmingham, 3.

Middlesbrough. — Church, Westbourne Grove; T. A. Crawford, architect, 80, Borough Road.

Stores, Linthorpe Road, for Marks & Spencer, Ltd.; Norman Jones, Son & Rigby, architects, Lord Street, Southport.

Houses (64), Ruskin Avenue; E. T. Sweeting & Sons, builders, Back Haymore Street, Middlesbrough.

Motherwell.—Semi-continuous strip mill; Colvilles, Ltd., Ravenscraig Works.

North Riding.—Primary school, Huntington; J. & C. Hull, Ltd., builders, Parliament Street, York.

Northampton.—Extensions to Town Hall (£250,000); E. J. Cave, borough engineer, Guildhall.

Northumberland.—Welfare home at Thomas Taylor Homes, Stannington (£60,000); Ashington Industrial Co-operative Society, contractors, Ashington.

Norwich.—Works and offices; Roneo, Ltd., Romford, Essex.

Ripon.—Blocks of flats and shop, Bondgate redevelopment scheme; Maurice Claye, town clerk, Town Hall.

Rugby.—New Town Hall and Council Offices, Newbold Road (£163,920); J. Parnell & Sons, Ltd., Rugby.

Ruislip.—Milk processing depot for Express Dairy Co., Ltd.; Gee, Walker & Slater, Ltd., builders, 100, Park Lane, London, W.1.

Sheffield.—Seven-storey physics block for University; Gollins, Melvin, Ward & Partners, architects, 281, Glossop Road.

Stevenage.—Seven-storey office block, with dance hall; L. G. Vincent, architect, Aston Hall.

Stoke-on-Trent.—Longton High School (six-storey teaching block), Meir; J. R. Piggott, architect, Kingsway Chambers.

Wallington.—Flats (42), Mill Green, London Road; Pite, Son & Fairweather, architects, 6, Queen Anne's Gate, London, S.W.1.

Whitley Bay.—Extensions to Whitley Bay fire station (£32,000); county architect, County Hall, Newcastle-on-Tyne.

Winchester.—Parish church, Stanmore Lane; C. W. T. Evans, architect, Wolvesey, Winchester.

Worksop.—Works for Steetley Co., West Hartlepool; Holst & Co., Ltd., contractors, 5/7, New York Road, Leeds.